

**ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE  
QUARTERLY  
ENVIRONMENTAL MONITORING REPORT  
APRIL - JUNE 1999**



US Department of Energy, Rocky Flats Field Office  
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**AUGUST 1999**  
RF/RMRS-99-421.UN

DOCUMENT CLASSIFICATION  
REVIEW WAIVER PER  
CLASSIFICATION OFFICE

**ADMIN RECORD**  
SW-A-003408

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## **HIGHLIGHTS FOR APRIL - JUNE 1999**

This report is produced and distributed quarterly as part of our ongoing Agreement in Principle and as a forum for the Rocky Flats Cleanup Agreement (RFCA) quarterly monitoring requirement. As discussed at a recent Exchange of Information Meeting, the Site is consolidating its reporting for selected media. In an effort to provide a more meaningful interpretation of the data presented and to save some natural resources, namely trees, the Site will be providing analytical data in the following formats:

Airborne effluent data is represented by a single graph providing cumulative plutonium emissions for 1997 and 1998. Ambient air data is represented by two graphs – a summary of estimated off-site dose as compared to a 10 Mrem per year standard, and air concentrations at perimeter sample locations expressed as a percentage of EPA's air concentration-based dose limit for members of the public. Meteorological data are represented by one windrose and a climatic summary for each month in the reporting period.

Compliance data in support of the Site National Pollutant Discharge Elimination System (NPDES) permit are presented without change. Analytical data collected in support of RFCA will be limited to the following locations: GS01, GS03, GS08, GS10, GS11, GS31, SW022, SW027, SW093, and SW091. Data include the hydrograph, mean daily flow and available water quality measurements for each location during the reporting period. Additional surface water locations supporting the Industrial Area Interim Measures/Interim Remedial Action (IA IM/IRA) program are GS27, GS32, GS39 and GS40 and are presented in the same manner as RFCA locations. Other stations may appear or be deleted, as performance monitoring locations are added or dropped, as well as any new source detection locations that may be required. Some locations, like GS32, have no flow monitoring capabilities and only analytical data are provided. An additional section provides quarterly summary information for the Incidental Waters program.

### **Airborne Effluent**

Discussions involving complete isotopic analytical data through May 1999 are included in this report. Data for June 1999 are not complete at this time. All data are within the normally observed ranges of concentrations for their respective locations.

Tritium data from April, May and June are missing six sample results. One sample in April, two samples in May and two samples in June were invalidated due to the bubbler volume being too low to adequately quantify the effluent air. Another sample in May is missing due to a broken sample bottle.

Consistent with all other uses of these data, positive values only are included in the total release calculation (the negative values are treated as zeros). The uncertainty calculation does reflect all values.

### **Hydrologic Monitoring and Rocky Flats Cleanup Agreement (RFCA) Monitoring**

All available analytical data collected during third quarter of FY 99 (April, May, and June) from samples supporting RFCA and Hydrologic Monitoring programs are included in this report

### **Incidental Water Monitoring**

A summary of Incidental Waters dispositioned during third quarter of FY99 (April, May, and June) are presented in this report

### **Appendix A**

Included in this appendix is the 1998 Public Radiation Dose Assessment for the Site

### **Appendix B**

Included in this appendix is the annual summary for the surface water locations previously included in the Annual Industrial Area Interim Measures/Interim Remedial Actions (IA IM/IRA) report

## 1. AIR DATA

### 1.1 EFFLUENT AIR DATA

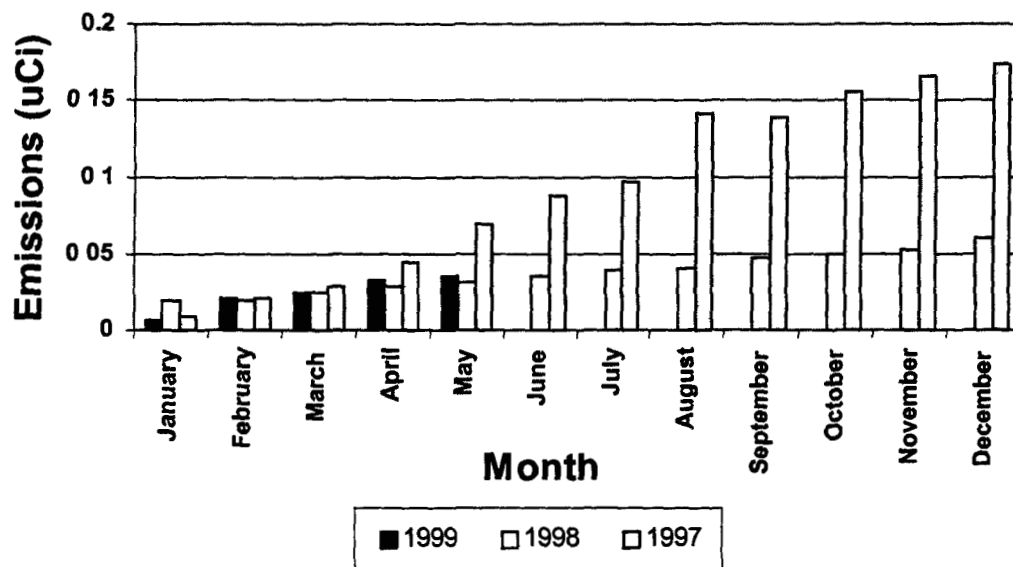


Figure 1-1 Cumulative Plutonium Airborne Effluent Emissions

The above graph shows the cumulative airborne effluent emissions of plutonium from building stacks. March, April and May 1999 emissions are consistent with previously measured concentrations in 1998, with a May cumulative, year-to-date plutonium emission of 0.03 microcuries (uCi). The total plutonium emissions for 1998 were 0.06 uCi, compared to the 0.17 uCi total plutonium emissions for 1997.

Americium and uranium emissions are low and quite variable, suggesting that the data are dominated by variability in the quantification method. Therefore, it is difficult to draw conclusions for americium and uranium. The monthly tritium airborne effluent emissions for January through May 1999 are below the mean monthly emissions in 1998.

## 1.2 AMBIENT AIR DATA

### 1.2.1 Perimeter Sampler Locations

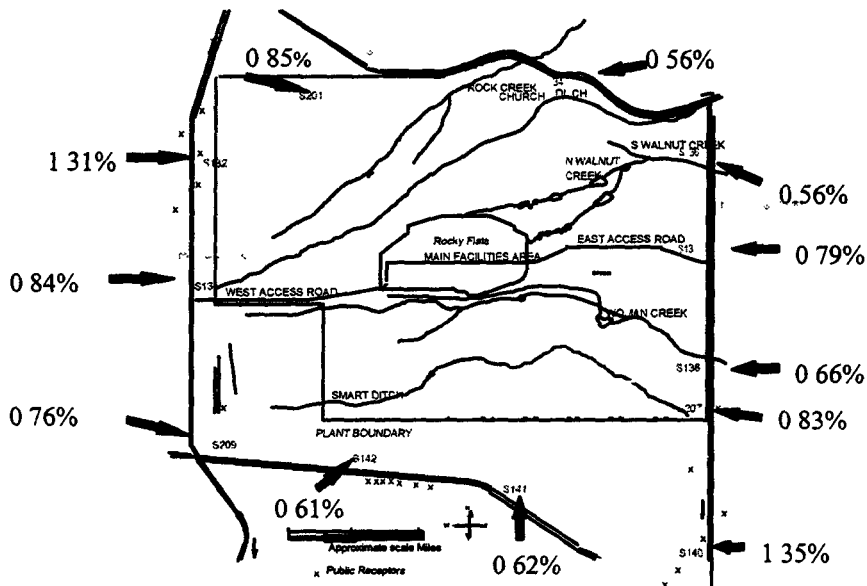


Figure 1-2 Perimeter Samplers Dose Map

The above map illustrates the perimeter Radioactive Ambient Air Monitoring Program (RAAMP) sampler locations and the twelve-month rolling-average maximum potential dose through May 1999, expressed as a percentage of EPA's air concentration-based dose limit for members of the public

The percentages include the naturally occurring uranium isotopes as well as the isotopes from site contributions. The average concentration observed at location S-140 is projected to equate to the highest dose, as we have typically seen in the past. The dose percentage for location S-132 is estimated, laboratory results and comparisons of fine and coarse particle concentrations suggest that the analytical results of the February fiberglass filter from S-132 and S-107 were mixed up in the reporting process.

The percentage values are based on the measured air concentrations, averaged over the year, converted as a percent of the Rad NESHAP concentration limits.

### 1.2.2 Perimeter Sampler Locations - Dose Rate Graphs, continued

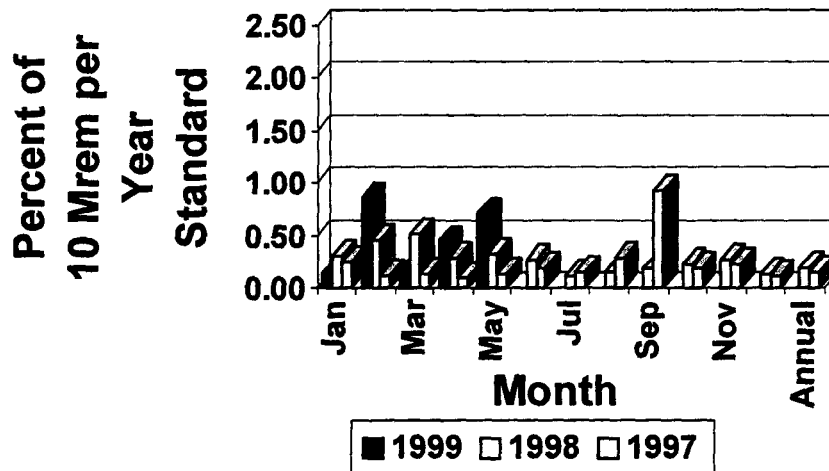


Figure 1-4 Offsite Dose Rate Summary Without U-234 and U-238

Omitting the uranium 234 and 238 contributions may better reflect the contribution from Site operations. This presentation results in an estimated maximum potential dose rate of less than 0.9% of the concentration limits.

Ambient concentrations and dose rates for 1999 are similar to the rates observed in 1997 and 1998.



## 2 METEOROLOGY AND CLIMATOLOGY

### 2.1 WIND ROSES FOR APRIL - JUNE 1999

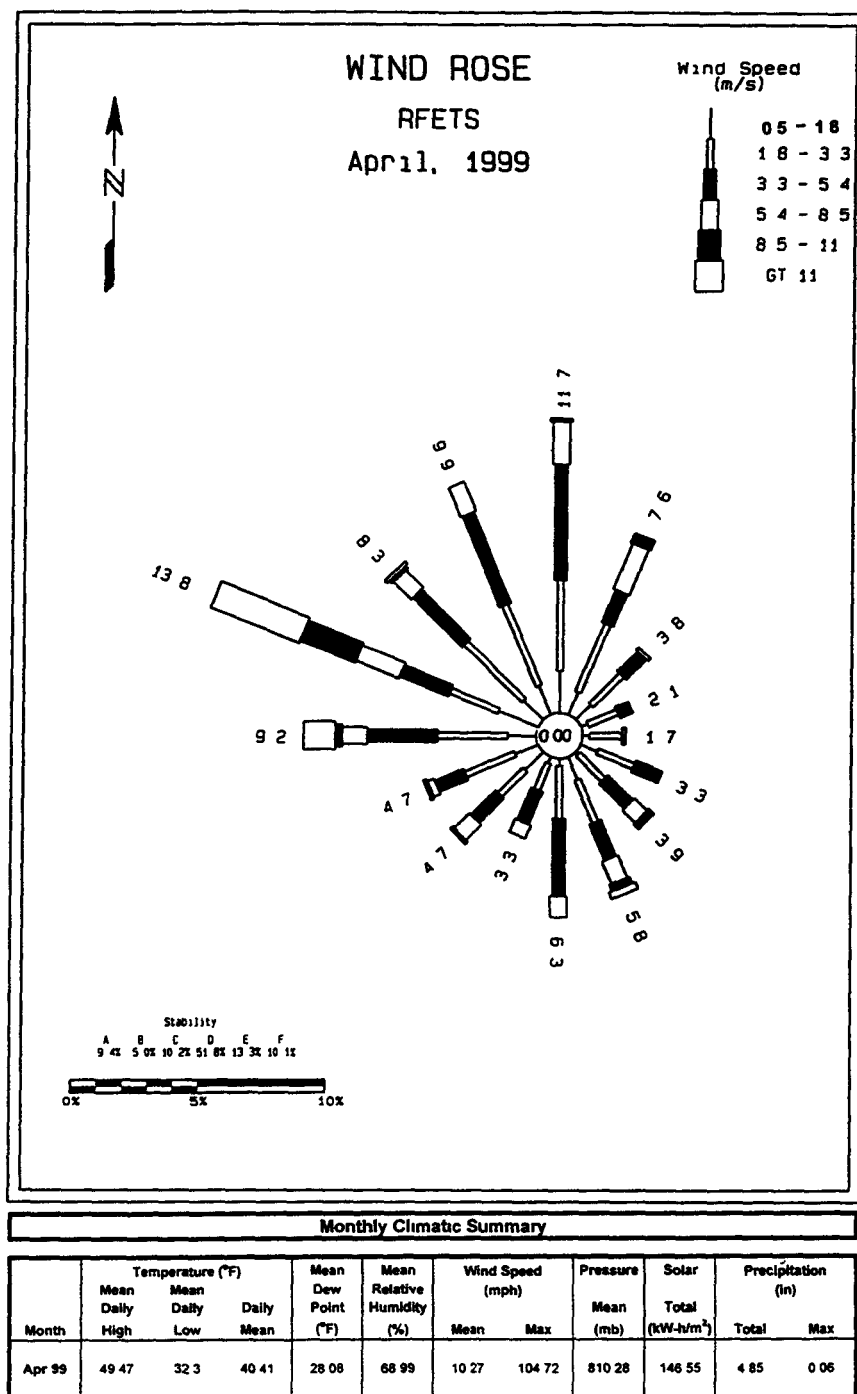


Figure 2-1 Wind Rose for Rocky Flats Environmental Technology Site for April 1999

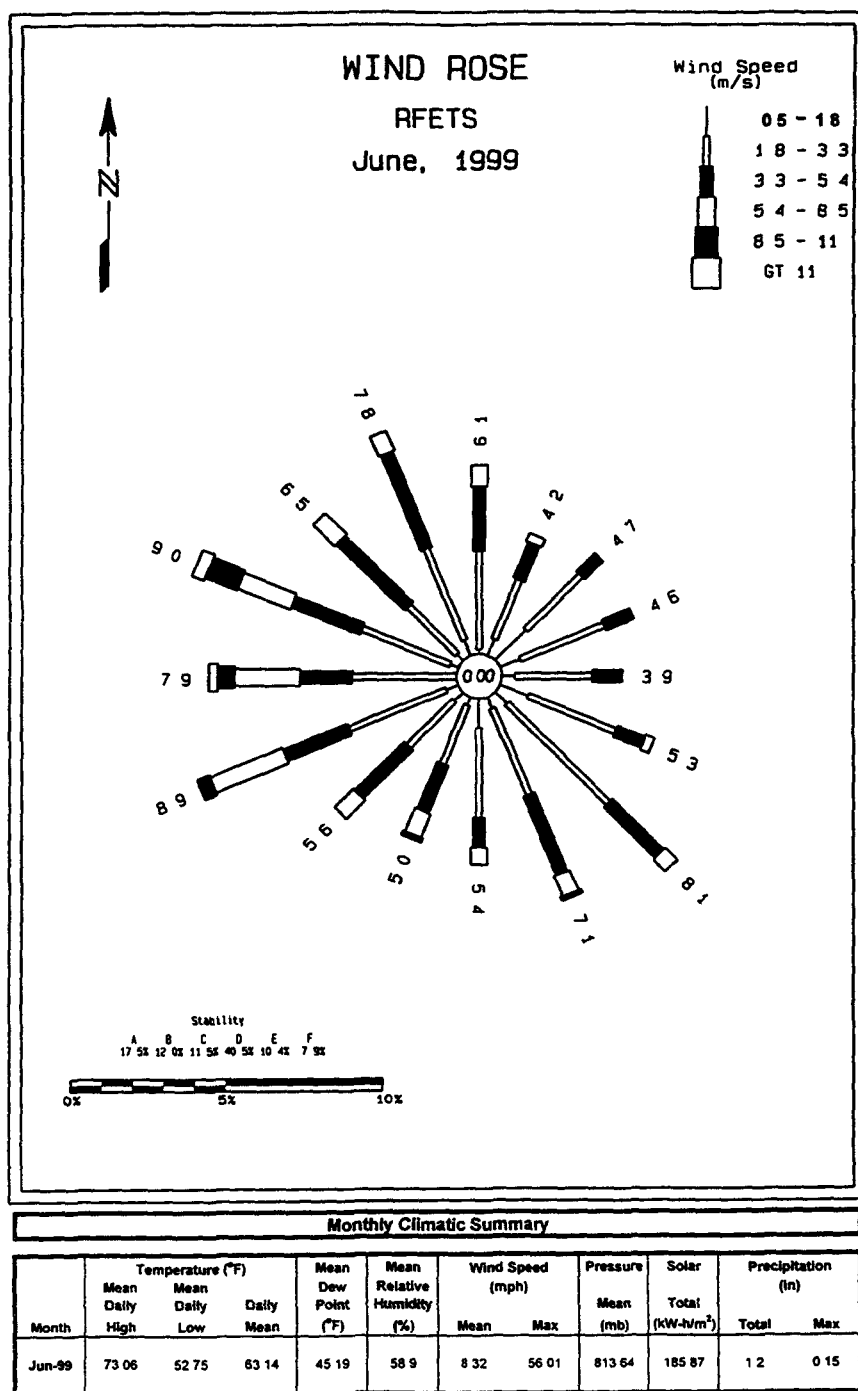


Figure 2-3 Windrose for Rocky Flats Environmental Technology Site for June 1999

### 3. SURFACE WATER DATA

Map 3-1 Holding Ponds and Liquid Effluent Water Courses

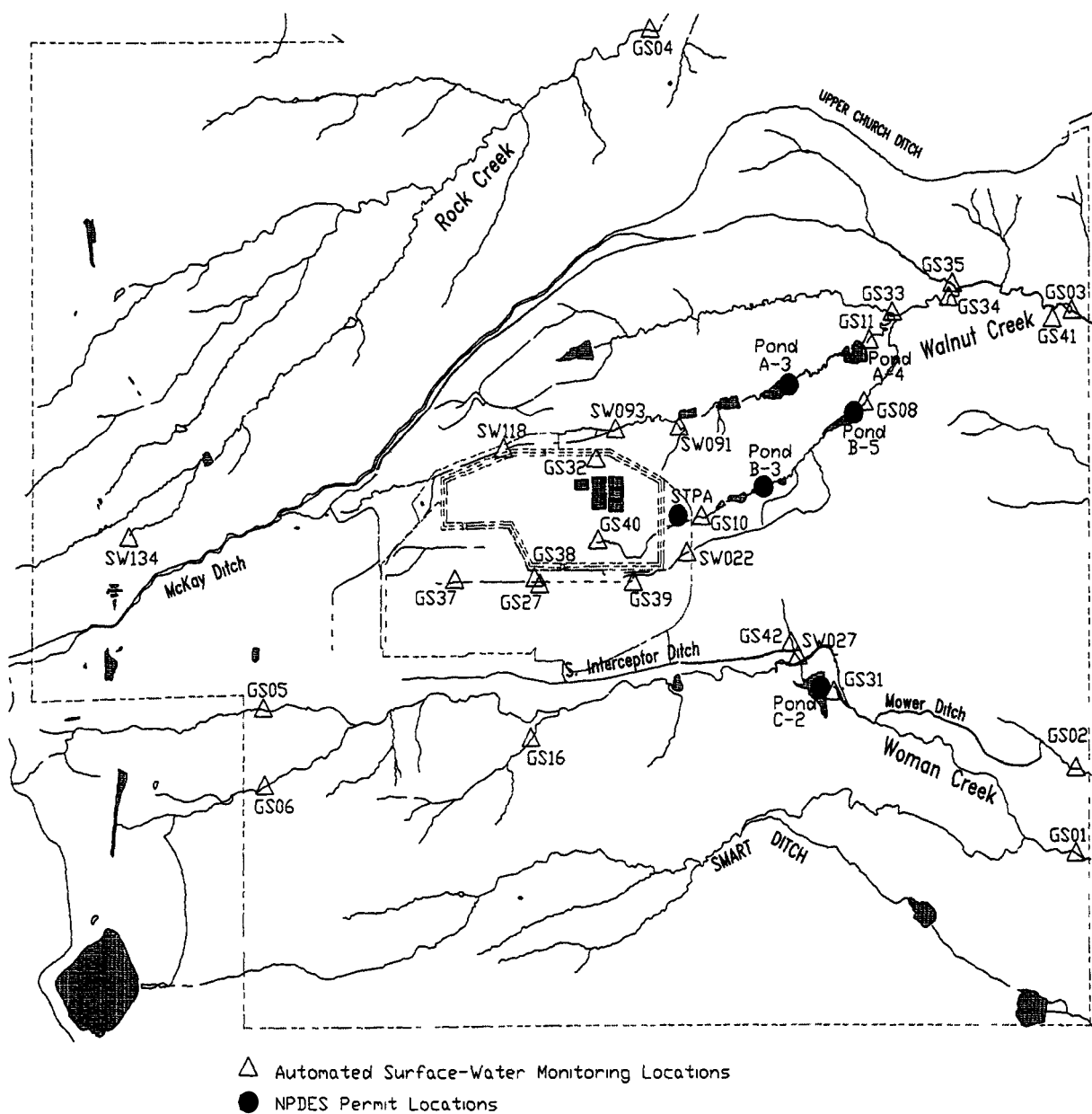


Table 3-2 Sewage Treatment Plant (Outfall STP A)

Dates of discharge 4/1/99 - 6/30/99 Metals and VOA samples collected 4/6/99, 5/4/99, &amp; 6/1/99

Parameter & Units	Measured 30-day Average	Limit 30-Day Average	Measured 7-Day Average	Limit 7-Day Average	Measured Daily Minimum	Limit Daily Minimum	Measured Daily Maximum	Limit Daily Maximum	Observed Sheen	Measured Result
pH, SU	N/A	N/A	N/A	N/A	6.4 - 6.6	6.0	7.2 - 7.3	9.0	N/A	N/A
TSS, mg/l	<5	30	<5	45	N/A	N/A	N/A	N/A	N/A	N/A
Total Phos, mg/l	0.8 - 1.5	8	N/A	N/A	N/A	N/A	1.5 - 5.0	12	N/A	N/A
TRC, mg/l	<0.02	a	0.03	a	N/A	N/A	N/A	N/A	N/A	N/A
Total Cr, ug/l	<1.0	50	N/A	N/A	N/A	N/A	1.2	100	N/A	N/A
F Coliform, #/100ml	<3	200b	<13	440b	N/A	N/A	N/A	N/A	N/A	N/A
CBOD5, mg/l	<3	10	N/A	N/A	N/A	N/A	3.0 - 5.0	25	N/A	N/A
Oil & Grease	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	c	N/A
WET										
Cenodaphnia	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	>100
Fathead Minnows	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	68, FAIL
Antimony, ug/l	<0.48 - 8.8	a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic, ug/l	<0.82 - 4.9	a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Beryllium, ug/l	<0.02	a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cadmium, ug/l	<0.10 - 0.27	a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Copper, ug/l	2.2 - 3.5	a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Iron, ug/l	50 - 76	a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lead, ug/l	<0.72	a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese, ug/l	6.1 - 15.9	a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mercury, ug/l	<0.10	a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nickel, ug/l	1.3 - 1.5	a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Silver, ug/l	<0.35	a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc, ug/l	17.4 - 33.6	a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
VOC's, ug/l	D	a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

a	Report Only	TRC	Total Residual Chlorine
b	Geometric Mean	CBOD5	Carbonaceous Biochemical Oxygen Demand, 5-Day Test
c	No Sheen Observed	PQL	Practical Quantitation Limit
d	None Detected Above PQL	WET	Whole Effluent Toxicity
N/A	Not Applicable	SU	Standard Units
TSS	Total Suspended Solids		

Table 3-4 Daily Transfer Flow Data Recorded for Pond B-5 to Pond A-4

Date	Pond B-5 to Pond A-4 (gal)	Date	Pond B-5 to Pond A-4 (gal)	Date	Pond B-5 to Pond A-4 (gal)
4/1/99	No Transfer	5/1/99	No Transfer	6/1/99	No Transfer
4/2/99	No Transfer	5/2/99	No Transfer	6/2/99	No Transfer
4/3/99	No Transfer	5/3/99	No Transfer	6/3/99	No Transfer
4/4/99	No Transfer	5/4/99	No Transfer	6/4/99	No Transfer
4/5/99	No Transfer	5/5/99	No Transfer	6/5/99	No Transfer
4/6/99	No Transfer	5/6/99	No Transfer	6/6/99	No Transfer
4/7/99	No Transfer	5/7/99	No Transfer	6/7/99	No Transfer
4/8/99	No Transfer	5/8/99	No Transfer	6/8/99	No Transfer
4/9/99	No Transfer	5/9/99	No Transfer	6/9/99	No Transfer
4/10/99	No Transfer	5/10/99	No Transfer	6/10/99	No Transfer
4/11/99	No Transfer	5/11/99	No Transfer	6/11/99	No Transfer
4/12/99	No Transfer	5/12/99	No Transfer	6/12/99	No Transfer
4/13/99	No Transfer	5/13/99	No Transfer	6/13/99	No Transfer
4/14/99	No Transfer	5/14/99	No Transfer	6/14/99	No Transfer
4/15/99	No Transfer	5/15/99	No Transfer	6/15/99	No Transfer
4/16/99	No Transfer	5/16/99	No Transfer	6/16/99	No Transfer
4/17/99	No Transfer	5/17/99	No Transfer	6/17/99	No Transfer
4/18/99	No Transfer	5/18/99	No Transfer	6/18/99	No Transfer
4/19/99	No Transfer	5/19/99	No Transfer	6/19/99	No Transfer
4/20/99	No Transfer	5/20/99	No Transfer	6/20/99	No Transfer
4/21/99	No Transfer	5/21/99	No Transfer	6/21/99	No Transfer
4/22/99	No Transfer	5/22/99	No Transfer	6/22/99	No Transfer
4/23/99	No Transfer	5/23/99	No Transfer	6/23/99	No Transfer
4/24/99	No Transfer	5/24/99	No Transfer	6/24/99	No Transfer
4/25/99	No Transfer	5/25/99	No Transfer	6/25/99	No Transfer
4/26/99	No Transfer	5/26/99	No Transfer	6/26/99	No Transfer
4/27/99	No Transfer	5/27/99	No Transfer	6/27/99	No Transfer
4/28/99	No Transfer	5/28/99	No Transfer	6/28/99	No Transfer
4/29/99	No Transfer	5/29/99	No Transfer	6/29/99	No Transfer
4/30/99	No Transfer	5/30/99	No Transfer	6/30/99	No Transfer
		5/31/99	No Transfer		
Total	No Transfer	Total	No Transfer	Total	No Transfer

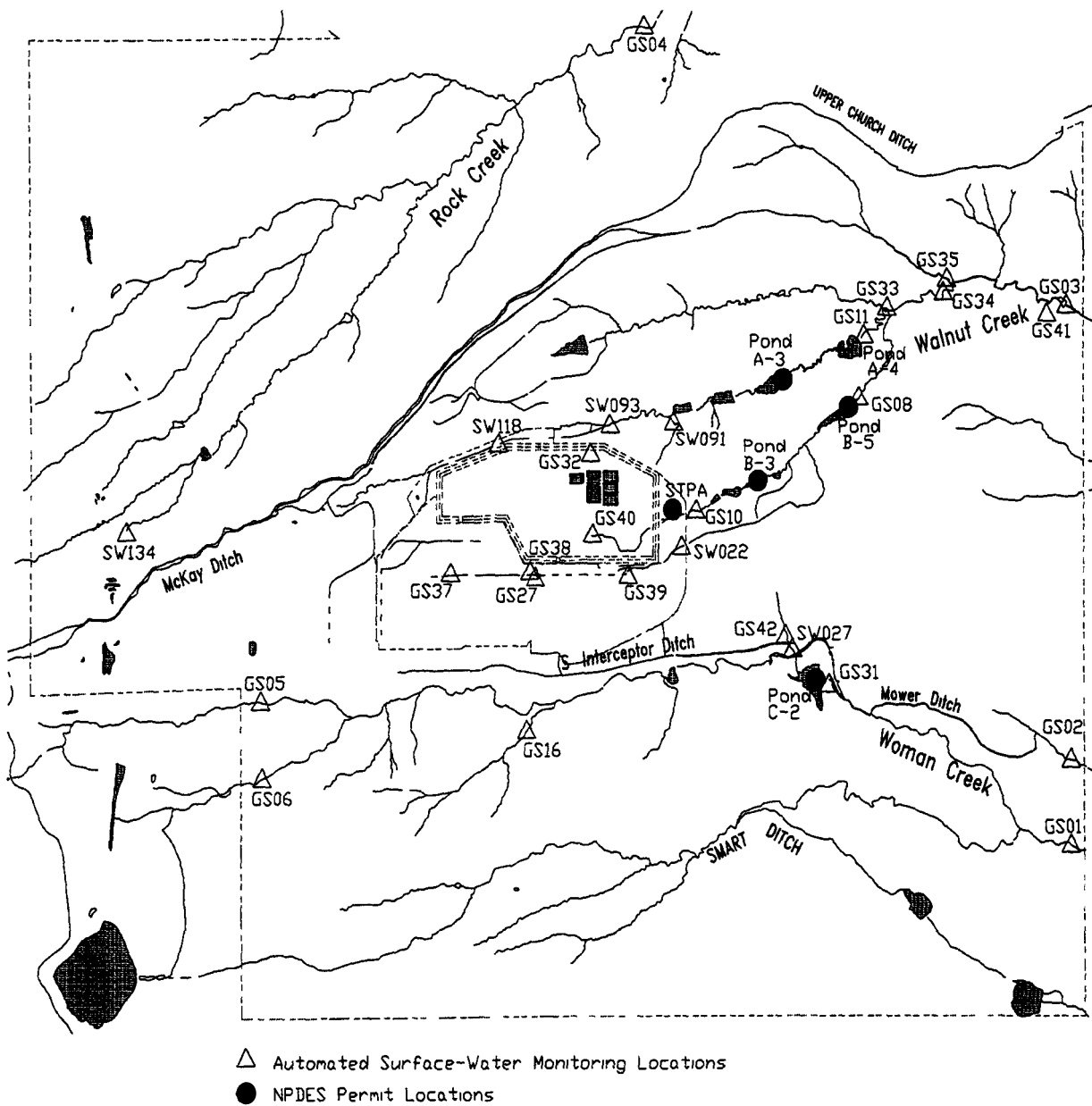
Table 3-5 Mound Plume Locations SW061 and SW132, continued

Analyte	SW061	SW132	SW061	SW132
	3/9/99	3/9/99	6/22/99	6/22/99
Pu 239/240, pCi/l	0 016	0 014	0 018	0 012
Am 241, pCi/l	0 026	0 020	0 003	0 001
Silver, dissolved, ug/l	<0 22	<0 22	<0 35	<0 35
Aluminum, total, ug/l	1310	74 8	473	45 4
Arsenic, total, ug/l	1 4 B	<0 82	<0 58	<0 58
Barium, total, ug/l	214	82 1 B	206	52 4
Beryllium, total, ug/l	0 06 B	<0 02	0 06	0 04
Cadmium, dissolved, ug/l	0 10 B	0 52 B	<0 08	<0 08
Copper, dissolved, ug/l	1 7 B	1 7 B	2 0	1 9
Iron, total, ug/l	1840	293	724	157
Mercury, total, ug/l	<0 1	<0 10	<0 10	<0 10
Manganese, total, ug/l	78 0	91 2	49 2	15 1
Nickel, dissolved, ug/l	2 4 B	1 6 B	1 6	1 1
Lead, dissolved, ug/l	<0 45	<0 45	<0 72	<0 72
Antimony, total, ug/l	1 2 B	5 2	1 1	2 1
Selenium, dissolved, ug/l	1 3 B	1 3 B	<1 2	1 6
Zinc, dissolved, ug/l	34 2	106	12 2	19 0

B - Absolute value of the analyzed result is less than the Contract Required Detection Limit (CRDL)

#### 4. HYDROLOGIC AND ROCKY FLATS CLEAN-UP AGREEMENT (RFCA) DATA

Map 4-1 Gaging Station Locations



Gaging Station GS01 is located at 39° 52' 40"N, 105° 09' 55"W, at Woman Creek and Indiana Street (See Section 4 Map) This station is a RFCA Point of Compliance, a Buffer Zone Monitoring Location and a monitoring point for water leaving the Site and flowing to Woman Creek Reservoir This station collects samples for selected radionuclides using continuous flow-paced sampling and storm event sampling for selected water quality parameters, metals, and major ions

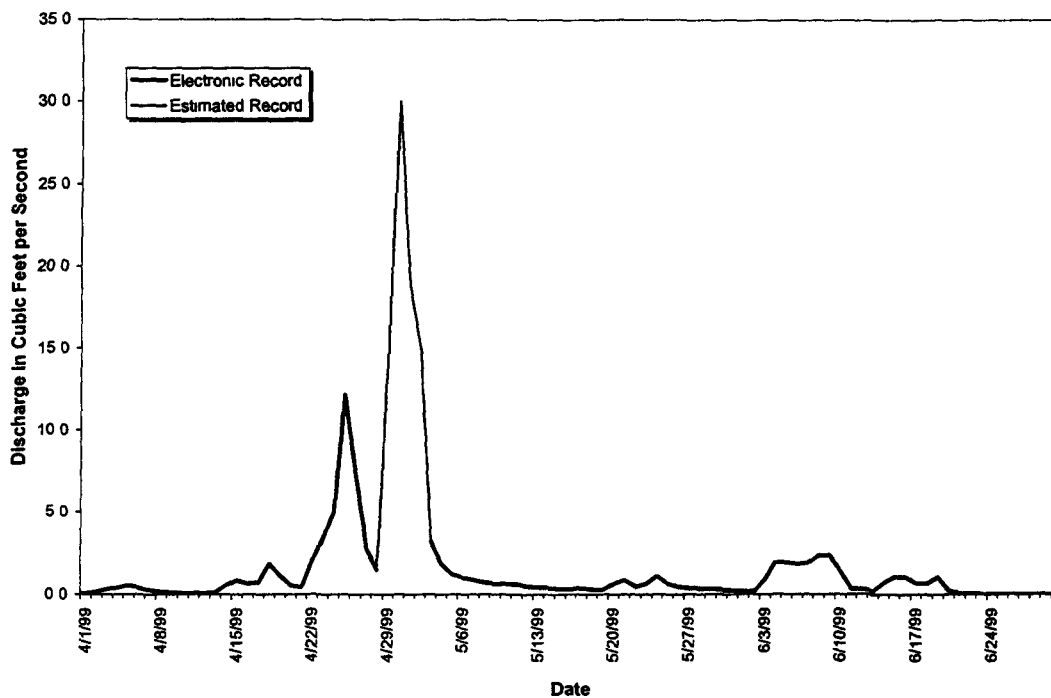


Figure 4-1 Mean Daily Discharge at GS01, Water Year 1999 (April, May, and June)



Gaging Station GS03 is located at 39° 54' 7"N, 105° 9' 59"W, at Walnut Creek and Indiana Street (See Section 4 Map) This station is a RFCA Point of Compliance, a Buffer Zone Monitoring Location and a monitoring point for water leaving the Site and flowing to the Broomfield Diversion Ditch This station collects samples for selected radionuclides using continuous flow-paced sampling and storm event sampling for selected water quality parameters, metals, and major ions

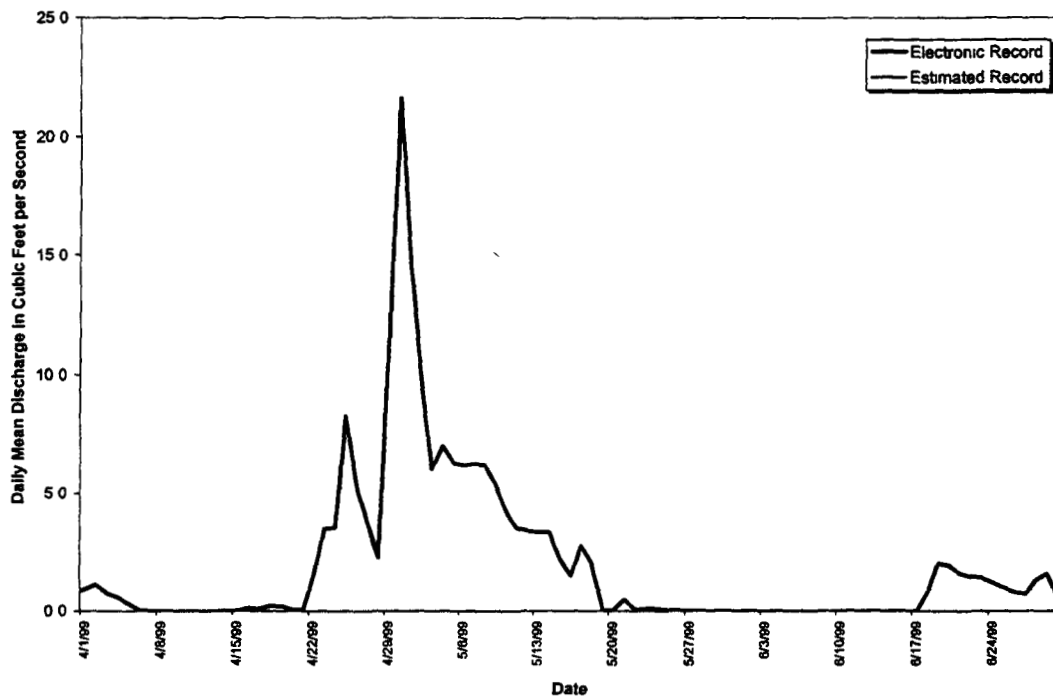


Figure 4-2 Mean Daily Discharge at GS03, Water Year 1999 (April, May, and June)

Gaging Station GS08 is located 39° 53' 54"N, 105° 10' 48"W, at the Pond B-5 Outfall on South Walnut Creek (See Section 4 Map) This station is a RFCA Point of Compliance and monitors water discharged from Pond B-5 to South Walnut Creek This station collects samples for selected radionuclides using continuous flow-paced sampling

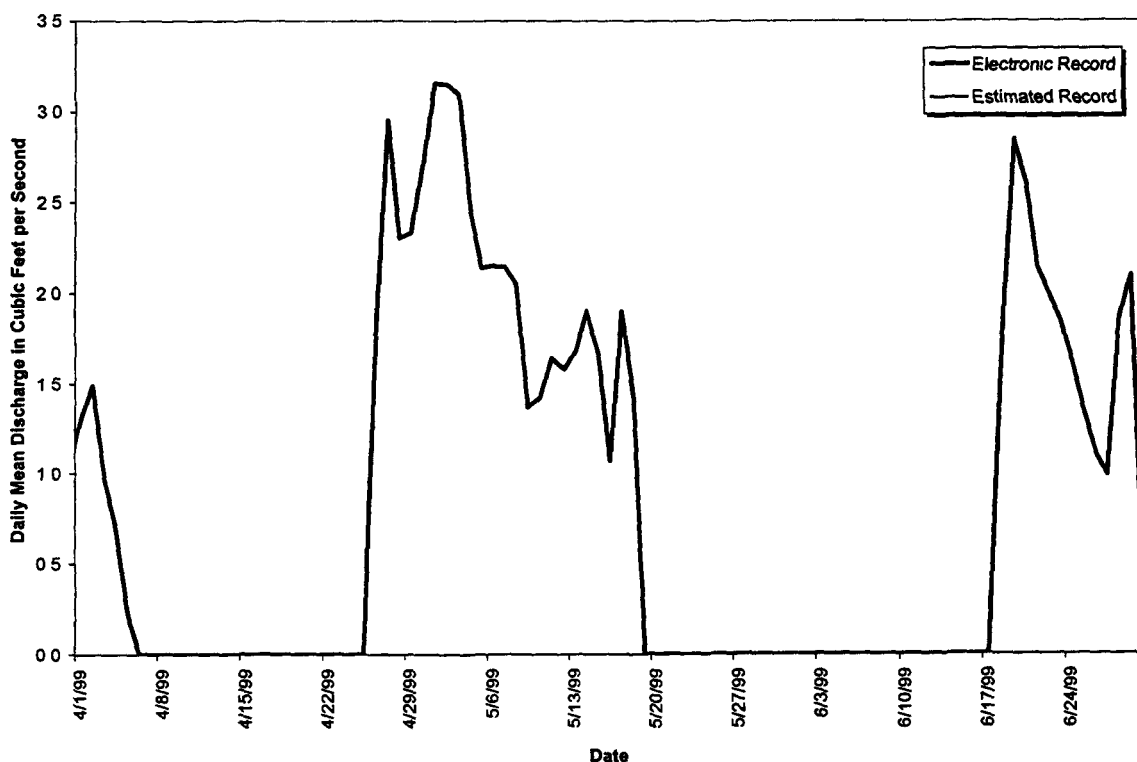


Figure 4-3 Mean Daily Discharge at GS08, Water Year 1999 (April, May, and June)

Gaging Station GS10 is located 39° 53' 35"N, 105° 11' 27"W on South Walnut Creek above the Pond B-1 Bypass (See Section 4 Map) This station is a RFCA Action Level Framework and a New Source Detection Location and monitors water leaving the Site Industrial Area and entering the B-Series Ponds and South Walnut Creek This station collects samples for selected radionuclides, metals, and water quality parameters using continuous flow-paced sampling

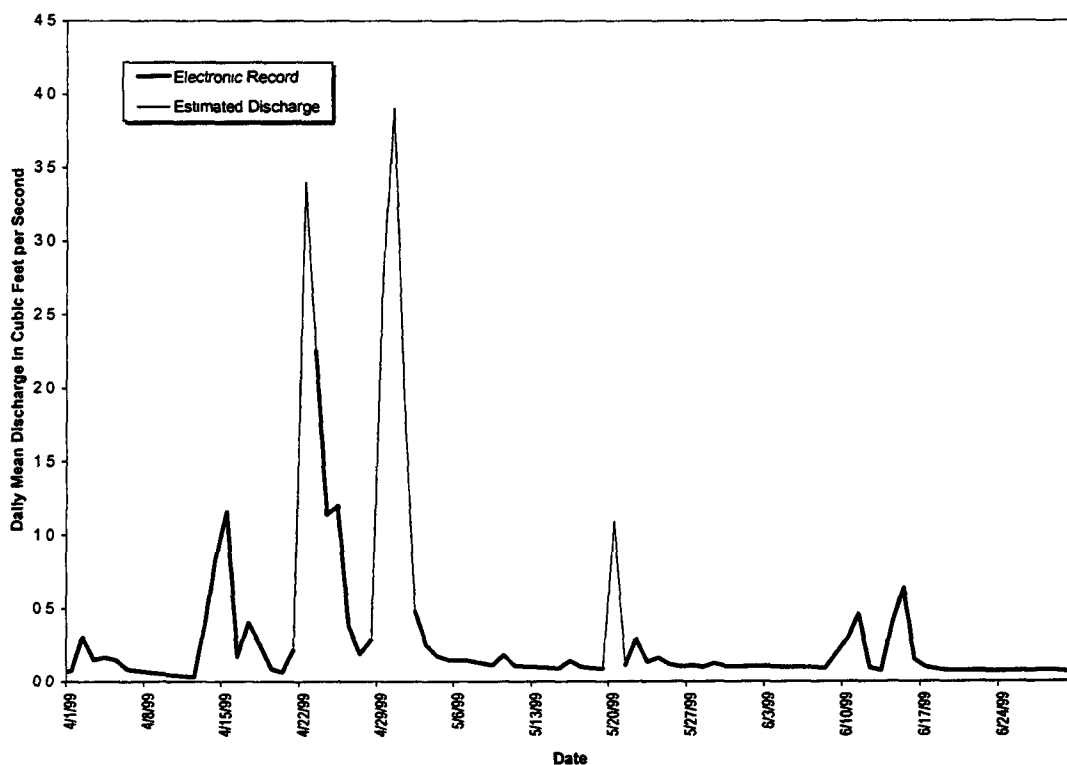


Figure 4-4 Mean Daily Discharge at GS10, Water Year 1999 (April, May, and June)

Gaging Station GS11 is located 39° 54' 3"N, 105° 10' 47"W, at the Pond A-4 Outfall on North Walnut Creek (See Section 4 Map) This station is a RFCA Point of Compliance and monitors water discharged from Pond A-4 to North Walnut Creek This station collects samples for selected radionuclides using continuous flow-paced sampling

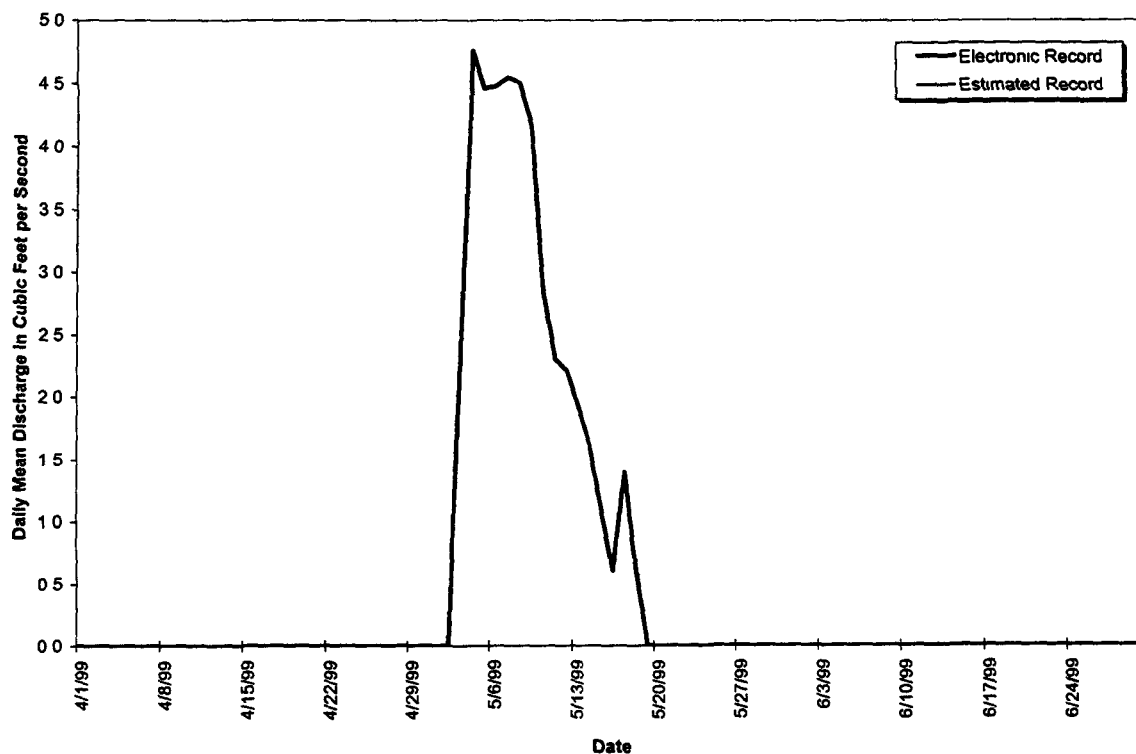


Figure 4-5 Mean Daily Discharge at GS11 Water Year 1999 (April, May, and June)

Gaging Station GS27 is located at State Plane 2080529, 751216, at the small drainage ditch NW of Building 884 (see Section 4 Map) This location is a Performance and Best Management Practices Monitoring Location and monitors water draining from the Building 889 area This station collects samples for selected radionuclides using continuous, flow-paced sampling

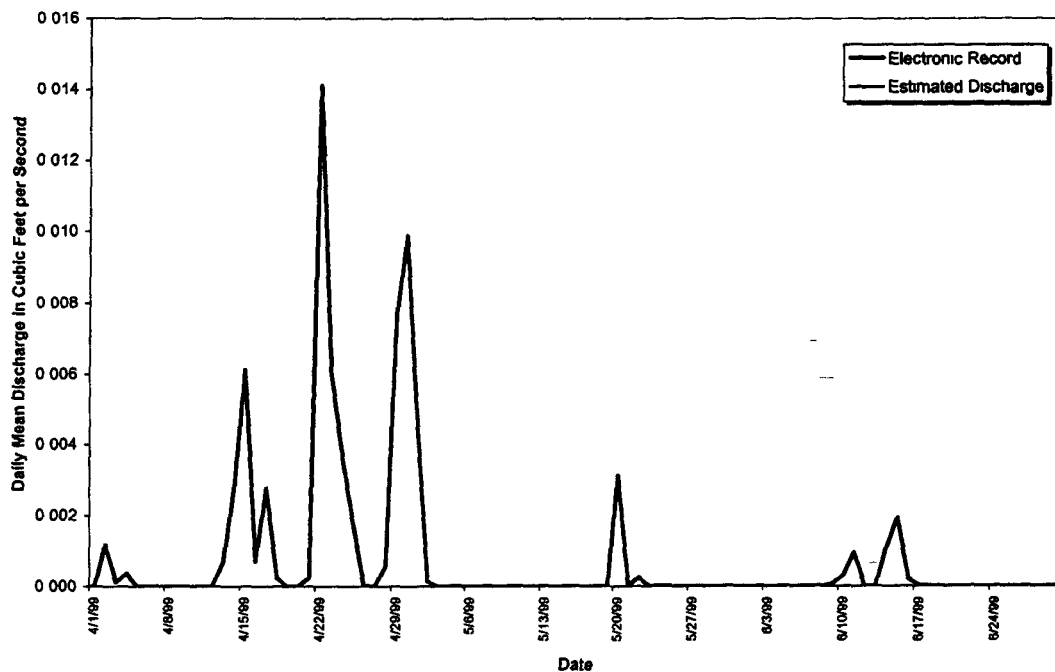


Figure 4-6 Mean Daily Discharge at GS27 Water Year 1999 (April, May, and June)

Gaging Station GS31 is located at State Plane 2089268 747506, at the Pond C-2 Outfall (See Section 4 Map) This station is a RFCA Point of Compliance and monitors water discharged from Pond C-2 This station collects samples for selected radionuclides using continuous flow-paced sampling

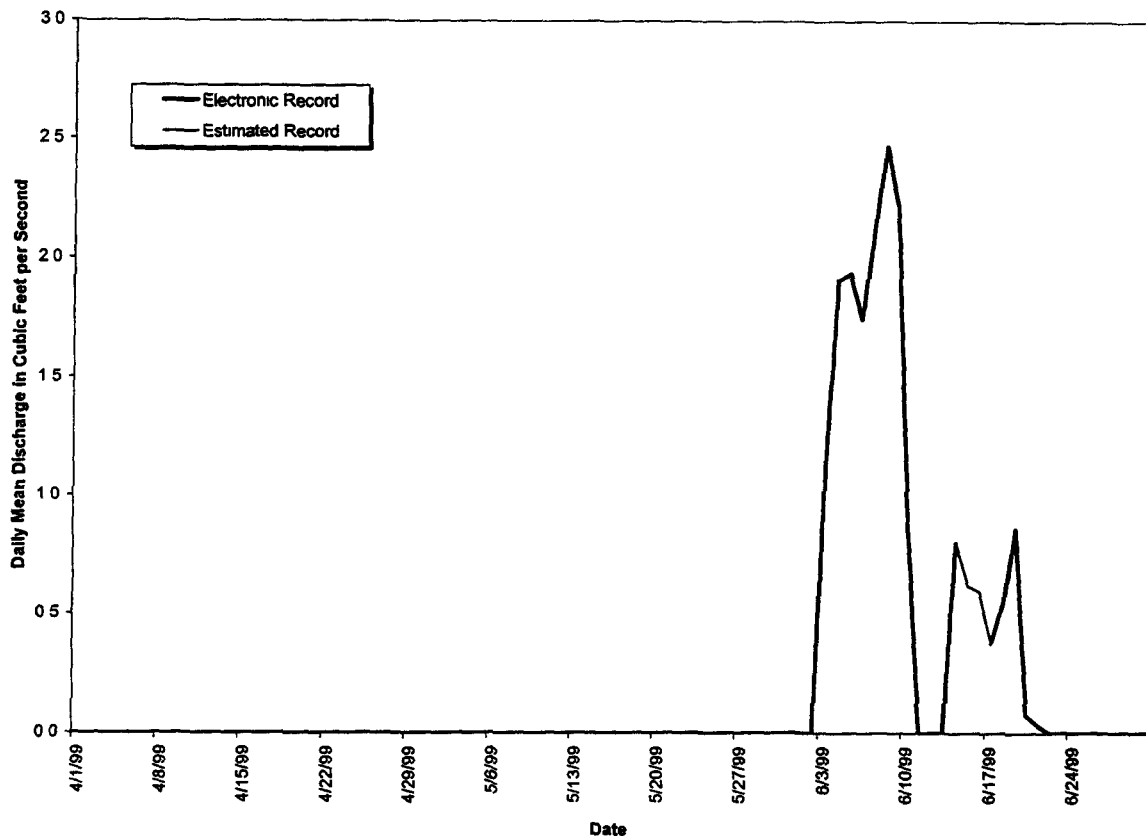


Figure 4-7 Mean Daily Discharge at GS31 Water Year 1999 (April, May, and June)

Gaging Station GS39 is located in the drainage ditch northwest of the 904 Pad. This location is a RFCA Source Location station monitoring water flowing from the area of the 903 Pad as well as part of the 904 Pad and contractor yard to South Walnut Creek. This station collects samples for selected radionuclides using continuous, flow-paced sampling.

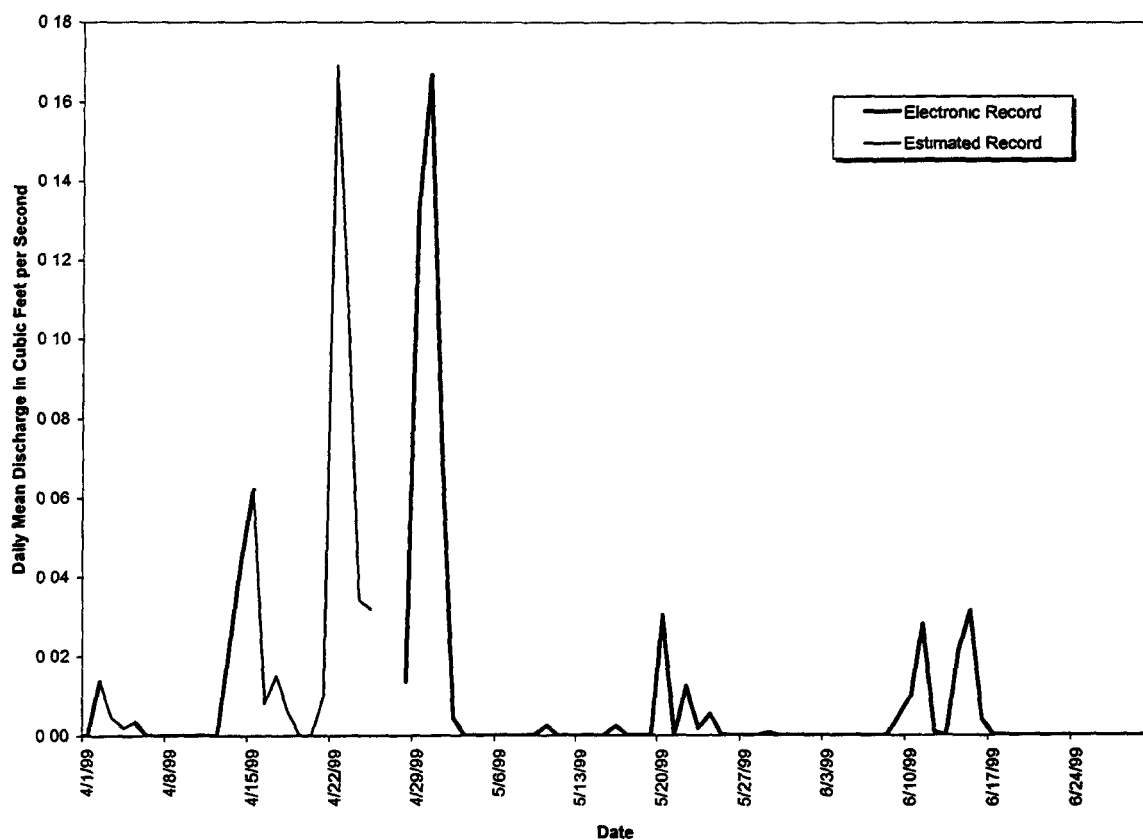


Figure 4-8 Mean Daily Discharge at GS39 Water Year 1999 (April, May, and June)

Gaging Station GS40 is located on the concrete spillway east of Tenth Street, south of Building 997. This location is a RFCA Performance Monitoring Location monitoring water flowing from the 700 area to South Walnut Creek. This station samples for selected radionuclides using continuous, flow-paced sampling.

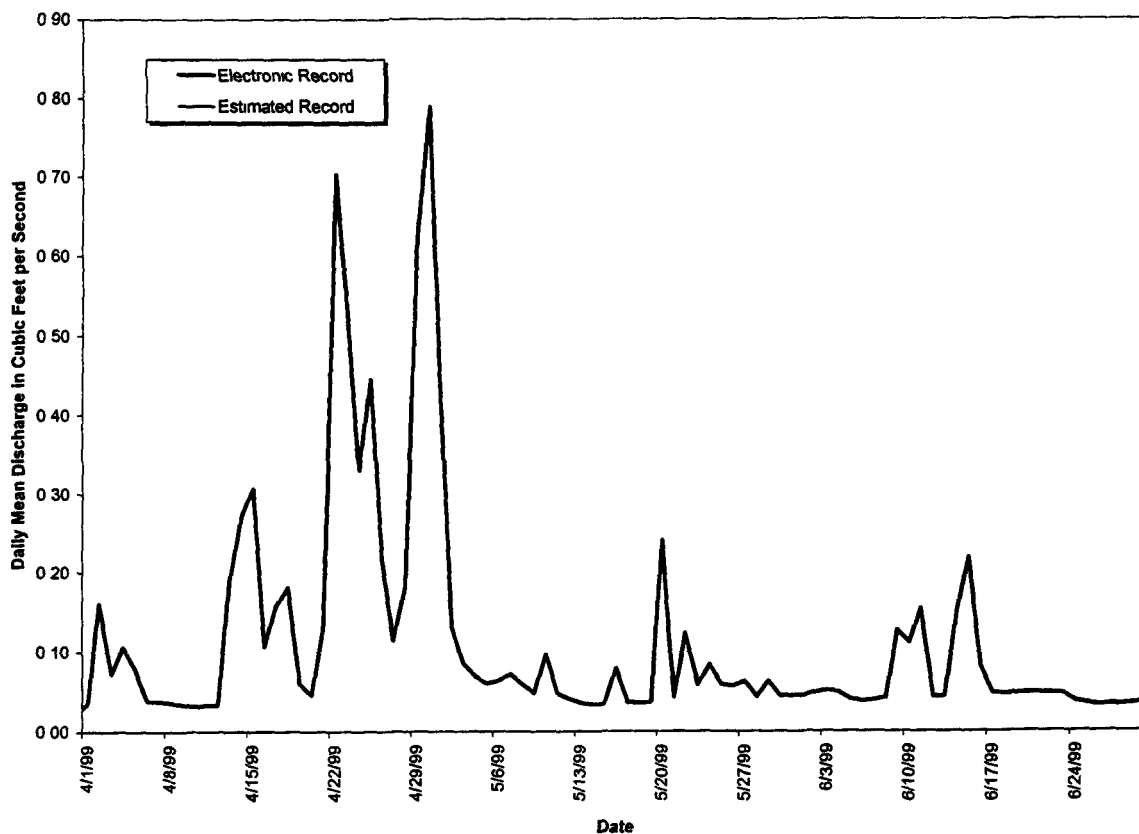


Figure 4-9 Mean Daily discharge at GS40 Water Year 1999 (April, May, and June)



Gaging Station SW091 is located at State Plane 2086064, 751322, along the drainage NE of the Solar Ponds draining to the A-Series Ponds (See Section 4 Map) This location is a RFCA New Source Detection Location and monitors water draining from the area NE of the Solar Ponds Storm event samples are collected for selected radionuclides

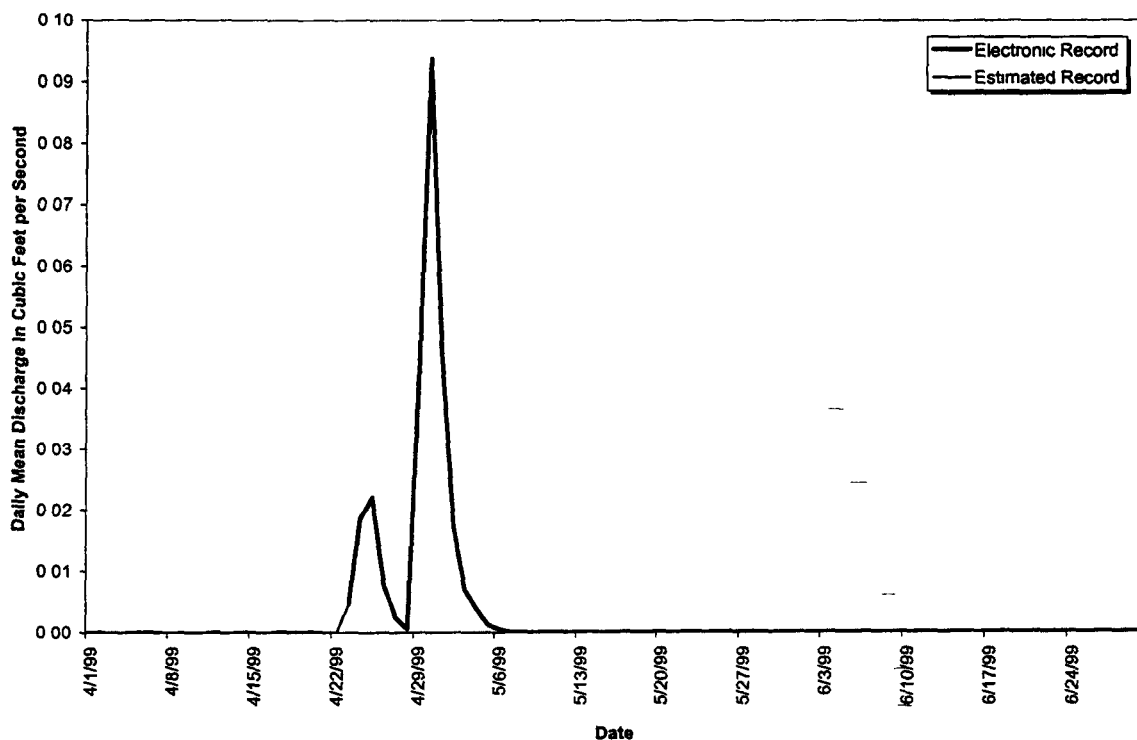


Figure 4-12 Mean Daily Discharge at SW091, Water Year 1999 (April, May, and June)

Table 4-12 Gaging Station SW091 Mean Daily Discharge (cubic feet per second)

Day	April-99	May-99	June-99
1	0 0000	0 0444	0 0000
2	0 0000	0 0171	0 0000
3	0 0000a	0 0070	0 0000
4	0 0000	0 0037	0 0000
5	0 0000	0 0012	0 0000
6	0 0000	0 0004	0 0000
7	0 0000	0 0000	0 0000
8	0 0000a	0 0000	0 0000
9	0 0000a	0 0000	0 0000
10	0 0000a	0 0000	0 0000
11	0 0000	0 0000	0 0000
12	0 0000	0 0000	0 0000
13	0 0000a	0 0000	0 0000
14	0 0001a	0 0000	0 0000
15	0 0000	0 0000	0 0000
16	0 0000a	0 0000	0 0000
17	0 0000	0 0000	0 0000
18	0 0001	0 0000	0 0000
19	0 0000	0 0000	0 0000
20	0 0000	0 0000	0 0000
21	0 0000a	0 0000	0 0000
22	0 0000a	0 0000	0 0000
23	0 0045	0 0000	0 0000
24	0 0186	0 0000	0 0000
25	0 0220	0 0000	0 0000
26	0 0078	0 0000	0 0000
27	0 0025	0 0000	0 0000
28	0 0005	0 0000	0 0000
29	0 0429	0 0000	0 0000
30	0 0937	0 0000	0 0000
31	NA	0 0000	NA
Monthly Average (cfs)	0 0064	0 0024	0 0000

## Monthly Discharge

Cubic Feet	16664	6382	6
Gallons	124654	47742	43
Acre-Feet	0 38	0 15	0 00

Note Mean flow values are reported to the nearest 0 001 cfs, values less than 0 0005 cfs are reported as zero

<sup>a</sup> Contains data estimated from field observations and electronic record at adjacent or comparable gages

Table 4-11 Gaging Station SW027 Mean Daily Discharge (cubic feet per second)

Day	April-99	May-99	June-99
1	0 000	1 109	0 000
2	0 000	0 623	0 000
3	0 000	0 133	0 000
4	0 000	0 041	0 000
5	0 010	0 018	0 000
6	0 008	0 008	0 000
7	0 005	0 005	0 000
8	0 003	0 004	0 000
9	0 001	0 004	0 000
10	0 000	0 004	0 000
11	0 000a	0 003	0 000
12	0 000	0 053	0 023
13	0 000	0 019	0 002
14	0 177	0 005	0 001
15	0 342	0 003	0 100
16	0 111	0 002	0 087
17	0 096	0 002	0 006
18	0 330	0 001	0 002
19	0 055	0 001	0 001
20	0 012	0 434	0 000
21	0 012	0 080	0 000
22	0 992	0 008	0 000
23	0 999	0 053	0 000
24	0 744	0 013	0 000
25	0 931	0 006	0 000
26	0 336	0 004	0 000
27	0 095	0 002	0 000
28	0 027	0 003	0 000
29	1 319	0 001	0 000
30	2 186	0 000	0 000
31	NA	0 000	NA
Monthly Average (cfs)	0 293	0 085	0 007

## Monthly Discharge

Cubic Feet	759353	228298	19158
Gallons	5680359	1707785	143311
Acre-Feet	17 43	5 24	0 44

Note Mean flow values are reported to the nearest 0 001 cfs, values less than 0 0005 cfs are reported as zero

<sup>a</sup> Contains data estimated from field observations and electronic record at adjacent or comparable gages

Gaging Station SW093 is located 39° 53' 51"N, 105° 11' 48"W, along North Walnut Creek at the 72" culvert 1000 feet above the Pond A-1 Bypass (See Section 4 Map) This station is a RFCA Action Level Framework and a New Source Detection Location and monitors water leaving the Site Industrial Area and entering the A-Series Ponds and North Walnut Creek This station collects samples for selected radionuclides, metals, and water quality parameters using continuous flow-paced sampling

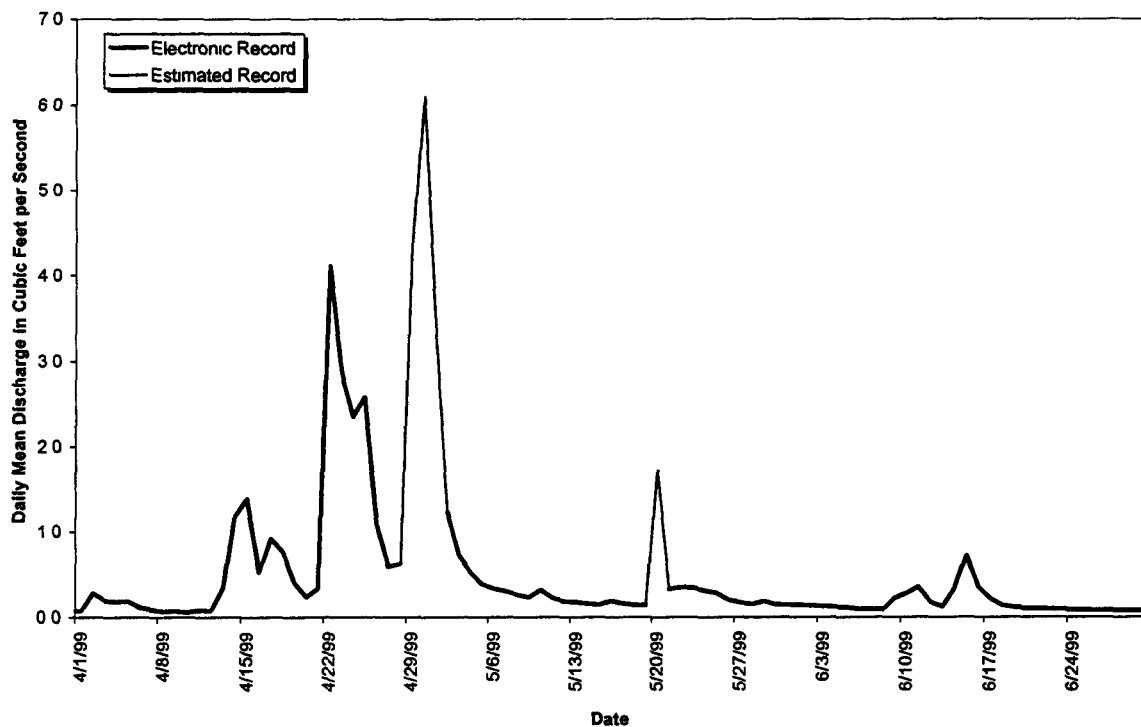


Figure 4-13 Mean Daily Discharge at SW093, Water Year 1999 (April, May, and June)

## 4.2 WATER QUALITY DATA

Table 4-14 Radionuclides, Water Year 1999 (April, May, and June)

Location	Sample Dates	Analyte Pu-239, -240 [pCi/l]	Analyte Am-241 [pCi/l]	Analyte Total Uranium [pCi/l]	Analyte Tritium [pCi/l]
GS01	3/3 - 3/24/99	0 000	-0 011	a	-181
GS01	3/24 - 4/13/99	-0 004	0 004	a	250
GS01	4/13 - 4/25/99	-0 003	0 006	a	190
GS01	4/25 - 4/27/99	-0 001	-0 006	a	140
GS01	4/27 - 4/29/99	0 021	-0 004	a	35
GS01	4/29 - 5/2/99	0 014	0 008	a	41
GS01	5/2 - 5/10/99	-0 004	0 001	a	180
GS01	5/10 - 6/3/99	0 005	-0 004	a	240
GS01	6/3 - 6/5/99	-0 002	-0 004	a	140
GS01	6/5 - 6/7/99	0 000	-0 007	a	260
GS01	6/7 - 6/14/99	0 019	0 000	a	240
GS01	6/14 - 6/21/99	0 010	0 039	a	270
GS01	6/21 - 8/5/99	b	b	a	b
GS03	4/5 - 4/25/99	0 015	0 013	a	27
GS03	4/25 - 4/26/99	0 013	-0 001	a	160
GS03	4/26 - 4/29/99	0 025	0 019	a	-69
GS03	4/29 - 5/2/99	0 024	0 007	a	0
GS03	5/2 - 5/4/99	0 068	0 018	a	240
GS03	5/4 - 5/5/99	0 005	0 008	a	140
GS03	5/5 - 5/7/99	0 022	0 005	a	430
GS03	5/7 - 5/8/99	0 023	0 046	a	190
GS03	5/8 - 5/10/99	-0 005	0 003	a	200
GS03	5/10 - 5/12/99	0 020	0 008	a	380
GS03	5/12 - 5/14/99	-0 004	0 018	a	380
GS03	5/14 - 5/19/99	0 018	0 002	a	200
GS03	5/19 - 6/18/99	c	c	a	c
GS03	6/18 - 6/23/99	0 016	0 007	a	140
GS03	6/23 - 7/1/99	0 005	0 006	a	210
GS08	3/22 - 3/25/99	0 007	-0 008	1 514	a

a Not applicable

b Incomplete laboratory analysis

c Non-sufficient quantity

Table 4-14 Radionuclides, Water Year 1999 (April, May, and June), continued

Location	Sample Dates	Analyte Pu-239, -240 [pCi/l]	Analyte Am-241 [pCi/l]	Analyte Total Uranium [pCi/l]	Analyte Tritium [pCi/l]
GS31	6/5 - 6/7/99	0 008	-0 004	2 383	a
GS31	6/7 - 6/14/99	0 012	0 008	2 315	a
GS31	6/14 - 6/21/99	0 154	0 033	3 917	a
GS32	4/21/99	0 019	-0 006	2 265	a
GS32	5/20/99	4 920	3 540	1 784	a
GS39	11/12/98 - 4/15/99	0 063	0 018	a	a
GS39	4/15 - 4/23/99	0 121	0 03	a	a
GS39	4/23 - 4/28/99	0 092	-0 006	a	a
GS39	4/28 - 4/30/99	0 136	0 049	a	a
GS39	4/30 - 5/10/99	0 074	0 018	a	a
GS39	5/10 - 6/15/99	0 041	0 016	a	a
GS39	6/15 - 8/2/99	b	b	a	a
GS40	2/8 - 3/30/99	0 0111	0 00912	a	a
GS40	3/30 - 4/20/99	0 047	0 043	a	a
GS40	4/20 - 4/28/99	0 019	0 016	a	a
GS40	4/28 - 5/5/99	0 02	0 025	a	a
GS40	5/5 - 6/4/99	0 01	0 059	a	a
GS40	6/4 - 6/29/99	0 026	0 063	a	a
GS40	6/29 - 7/27/99	b	b	a	a
SW022	4/21/99	0 046	0 003	3 824	a
SW022	4/28/99	0 028	0 004	3 114	a
SW022	4/29/99	0 240	0 075	3 913	a
SW022	5/20/99	1 430	0 354	2 080	a
SW022	6/14/99	0 137	0 038	0 958	a
SW022	6/15/99	0 099	0 026	1 486	a
SW027	11/10/98 - 4/15/99	0 010	0 019	1 860	a
SW027	4/15 - 4/19/99	0 016	-0 004	1 822	a
SW027	4/19 - 4/23/99	0 030	-0 003	1 125	a
SW027	4/23 - 4/26/99	0 018	0 014	2 181	a
SW027	4/26 - 4/30/99	0 134	0 011	2 176	a
SW027	4/30 - 5/1/99	0 190	0 027	1 824	a
SW027	5/1 - 5/7/99	0 087	0 064	3 673	a
SW027	5/7 - 6/18/99	0 001	0 017	2 086	a
SW027	6/18 - 8/1/99	b	b	b	a
SW091	4/23/99	0 005	-0 003	3 205	a

a Not applicable

b Incomplete laboratory analysis

Table 4-15 POE Metals, Water Year 1999 (April, May, and June)

Location	Sample Dates	Analyte Be ug/L	Analyte Dissolved Cd ug/L	Analyte Cr ug/L	Analyte Dissolved Ag ug/L
GS10	12/1/98 - 1/4/99	0 12	undetect	0 81	undetect
GS10	3/15 - 3/30/99	undetect	undetect	0 85	undetect
GS10	3/30 - 4/15/99	undetect	undetect	1 1	undetect
GS10	4/15 - 4/22/99	0 26	0 12	7 9	undetect
GS10	4/22 - 4/24/99	0 12	0 14	5 3	undetect
GS10	4/24 - 4/29/99	0 12	0 11	4 9	undetect
GS10	4/29 - 5/1/99	0 07	undetect	4	undetect
GS10	5/1 - 5/10/99	0 05	0 09	2 7	undetect
GS10	5/10 - 5/24/99	0 76	undetect	16 4	undetect
GS10	5/24 - 6/10/99	0 08	undetect	2 7	undetect
GS10	6/10 - 6/14/99	0 29	0 08	6 9	undetect
GS10	6/14 - 6/17/99	0 17	undetect	2 8	undetect
GS10	6/17 - 6/29/99	0 05	undetect	1 2	undetect
GS10	6/29 - 7/8/99	a	a	a	a
SW027	11/10/98 - 4/15/99	0 31	0 12	12 8	undetect
SW027	4/15 - 4/19/99	undetect	0 09	1 1	undetect
SW027	4/19 - 4/23/99	undetect	0 08	2	undetect
SW027	4/23 - 4/26/99	undetect	undetect	0 92	undetect
SW027	4/26 - 4/30/99	0 05	0 09	2 4	undetect
SW027	4/30 - 5/1/99	undetect	0 08	1 6	undetect
SW027	5/1 - 5/7/99	undetect	0 17	1 3	undetect
SW027	5/7 - 6/18/99	0 09	0 08	2 1	undetect
SW027	6/18 - 8/1/99	a	a	a	a
SW093	3/16 - 3/30/99	undetect	undetect	0 29	undetect
SW093	3/30 - 4/15/99	0 09	undetect	3 9	undetect
SW093	4/15 - 4/19/99	0 04	0 08	2 5	undetect
SW093	4/19 - 4/23/99	0 09	0 1	6 2	undetect
SW093	4/23 - 4/26/99	undetect	0 09	3	undetect
SW093	4/26 - 4/29/99	0 32	0 12	9 2	undetect
SW093	4/29 - 5/1/99	0 15	0 11	5	undetect
SW093	5/1 - 5/4/99	0 12	0 26	4 6	undetect
SW093	5/4 - 5/17/99	0 06	undetect	0 75	undetect
SW093	5/17 - 5/24/99	0 82	undetect	18 3	undetect
SW093	5/24 - 6/8/99	a	a	a	a
SW093	6/8 - 6/14/99	0 19	undetect	4 8	undetect
SW093	6/14 - 6/16/99	0 24	0 22	6 1	undetect

a Incomplete laboratory analysis

Table 4-16 Other Metals Water Year 1999 (April, May, and June)

Analyte ug/l	Result GS32, 4/21/99	Result GS32, 5/20/99	Result SW022, 4/21/99	Result SW022, 4/28/99
Aluminum	126	28500	2650	1520
Antimony	0 62	3 3	22 4	15 2
Arsenic	undetect	12 5	2	1 6
Barium	43 6	285	72 2	78 6
Beryllium	undetect	1 8	0 09	0 08
Cadmium	0 18	2 7	0 1	0 2
Calcium	30500	75200	34100	39500
Chromium	0 67	46 9	3 8	1 9
Cobalt	undetect	11 5	0 73	0 42
Copper	4 1	87 2	7 7	6 1
Iron	131	32100	2170	1070
Lead	undetect	48	2 4	1 8
Lithium	5 1	31 7	7 3	5 1
Magnesium	5540	8770	7310	8120
Manganese	19 2	664	33 4	20 4
Mercury	undetect	0 12	undetect	undetect
Molybdenum	0 89	3 6	1 1	1 4
Nickel	2 1	30 1	2 7	1 8
Potassium	3240	10500	4200	3700
Selenium	undetect	undetect	undetect	undetect
Silver	undetect	undetect	undetect	undetect
Sodium	30200	21700	46900	40600
Strontium	180	164	225	273
Thallium	undetect	1 3	undetect	0 92
Tin	undetect	2 7	undetect	undetect
Vanadium	0 92	70 4	6 6	4
Zinc	501	1030	86 4	95 9



Table 4-17 Water Quality Parameters, Water Year 1999 (April, May, and June)

Location	Sample Dates	Analyte Hardness mg/L
GS10	3/30 - 4/15/99	160
GS10	4/15 - 4/22/99	84
GS10	4/22 - 4/24/99	70
GS10	4/24 - 4/29/99	96
GS10	4/29 - 5/1/99	69
GS10	5/1 - 5/10/99	170
GS10	5/10 - 5/24/99	170
GS10	5/24 - 6/10/99	240
GS10	6/10 - 6/14/99	120
GS10	6/14 - 6/17/99	100
GS10	6/17 - 6/29/99	250
GS10	6/29 - 7/8/99	a
SW027	11/10/98 - 4/15/99	120
SW027	4/15 - 4/19/99	140
SW027	4/19 - 4/23/99	98
SW027	4/23 - 4/26/99	130
SW027	4/26 - 4/30/99	110
SW027	4/30 - 5/1/99	100
SW027	5/1 - 5/7/99	130
SW027	5/7 - 6/18/99	130
SW027	6/18 - 8/1/99	a
SW093	3/30 - 4/15/99	190
SW093	4/15 - 4/19/99	140
SW093	4/19 - 4/23/99	88
SW093	4/23 - 4/26/99	110
SW093	4/26 - 4/29/99	88
SW093	4/29 - 5/1/99	75
SW093	5/1 - 5/4/99	110
SW093	5/4 - 5/17/99	210
SW093	5/17 - 5/24/99	130
SW093	5/24 - 6/8/99	230
SW093	6/8 - 6/14/99	170
SW093	6/14 - 6/16/99	110
SW093	6/16 - 6/24/99	240
SW093	6/24 - 7/2/99	320

a Incomplete laboratory analysis

## 5.2 QUARTERLY INCIDENTAL WATER DISPOSITIONS

Forty-five (45) incidental waters were sampled and dispositioned during the third quarter of FY99. The majority of these were associated with routine Site activities, such as dewatering secondary containments surrounding transformers, and accessing utility manholes. The following table summarizes the location and route of disposal for those incidental waters sampled.

Table 5-2 Quarterly Incidental Water Dispositions FY1999 (April, May, and June)

Location/ Building	Location Type	# of Incidental Waters	Route of Disposal
223	Transformer Berm	4	Treatment
371	Secondary Containment	1	Treatment
443	Transformer Berm	1	Discharge to Ground
549	Transformer Berm	1	Treatment
551	Transformer Berm	1	Treatment
708	Transformer Berm	3	Treatment-(2), Discharge to Ground-(1)
709	Building Pit	1	Treatment
750	Transformer Berm	1	Discharge to Ground
771	Transformer Berm	1	Discharge to Ground
772	Transformer Berm	1	Discharge to Ground
776	Secondary Containment	2	Discharge to Ground
776	Transformer Berm	1	Discharge to Ground
777	Secondary Containment	1	Discharge to Ground
828	Building Pit	2	Treatment
865	Transformer Berm	3	Treatment
875	Foundation Drain	1	Discharge to Ground
881	Building Pit	1	Treatment
881	Secondary Containment	4	Treatment-(3), Discharge to Ground-(1)
881	Transformer Berm	1	Treatment
883	Transformer Berm	1	Discharge to Ground
886	Electrical Pit	1	Discharge to Ground
886	Foundation Drain	2	Discharge to Ground
PU & D Yard	Drum	2	Discharge to Ground
Buffer Zone	Excavation	1	Treatment
Industrial Area	Manholes	8	Treatment-(4), Discharge to Ground-(4)

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- 3 The exposure pathways (inhalation, ingestion, etc ) by which these members of the public may be exposed to the released radioactive material need to be defined, and
- 4 The radiation dose received by these members of the public need to be assessed

DOE Order 5400.5 encourages the use of realistic, but conservative, approaches to radiation dose assessment. The radiation dose assessment performed in this report uses this approach.

### Sources of Radioactive Material

The radioactive material released to the environment at RFETS includes isotopes of americium, plutonium, uranium and tritium. For CY 1998, these radioactive materials were released from RFETS through air emissions and through surface water emissions. There have also been past releases from RFETS that have deposited americium and plutonium on surface soils east of RFETS. These surface soils were investigated as Operable Unit #3 at RFETS. Annual emissions of radioactive material in air and water plus past depositions of radioactive material in surface soils will be used to assess the radiation dose to the public during CY 1998.

The radioactive material released in air from RFETS is quantified in the 1998 Radionuclide Air Emissions Annual Report. This report was developed to comply with the requirements from the Environmental Protection Agency (EPA) in Title 40 of the Code of Federal Regulations (CFR), Part 61 and from the Colorado Air Quality Control Commission Regulations. All sources of radioactive material (Both point sources and area sources) at RFETS are assessed in this report with their associated air emissions. Air emissions are then translated into air concentrations of radioactive material outside of the boundary of RFETS through modeling. Measured air concentrations are also reported at the boundary of RFETS. Air concentrations of radioactive material from this report are used to quantify the amount of radioactive material inhaled by members of the public. The deposition rate of radioactive material onto surface soils is also assessed in this report. Surface soil concentrations of radioactive material will be used to quantify the amount of radioactive material ingested in soil by a member of the public as well as to quantify external radiation exposure to a member of the public.

The radioactive material released in water from RFETS is quantified through routine surface water monitoring activities. In 1998, Ponds A-4, B-5 and C-2 released water offsite in a batch manner. The pond discharge water was analyzed for radioactive material. The volume of water was recorded for each release. Volume-weighted average surface water concentrations of radioactive material are used to quantify the amount of radioactive material ingested by members of the public.

As a result of past releases of radioactive material at RFETS, there are elevated levels of radioactive material in surface soils east of RFETS. The amount of radioactive material in surface soils is documented in the Final Resource Conservation and Recovery Act Facility Investigation/Remedial Investigation Report for Operable Unit #3 (Offsite Areas). Surface soil samples taken to support the Operable Unit #3 Report will be used to quantify the amount of radioactive material near a member of the

released from RFETS into Walnut Creek is diverted around Great Western Reservoir to Big Dry Creek and subsequently to the South Platte River. Big Dry Creek contributes less than 0.2 percent to the total flow in the South Platte River. There is no drinking water supply use of the South Platte River from the confluence of Big Dry Creek along the entire reach to the confluence of the North Platte River in Nebraska. In Woman Creek, surface water is discharged to the creek where water flows to any one of three cells in the Woman Creek Reservoir, located just east of Indiana Avenue. The surface water within these cells is pumped to Walnut Creek just east of Great Western Reservoir. The water then follows the same path as the waters released into Walnut Creek. Due to these circumstances, it is not reasonable to assume that a resident would use the surface water released from RFETS for household use. It is reasonable to assume though that the residents near the eastern boundary of RFETS may come into contact with surface waters released from RFETS in a recreational capacity. It is therefore assumed that residents might wade in surface waters periodically and incidentally ingest these surface water at these times. Exposure parameters for this recreational exposure were taken from the open space exposure scenario, which is defined in Appendix P, "Programmatic Preliminary Remediation Goals," of the Implementation Guidance Document within the Rocky Flats Cleanup Agreement (RFCA).

#### Radiation Dose Assessment

In order to develop the radiation dose to the MEI member of the public, the location of the MEI must be determined. From the 1998 Radionuclide Air Emissions Annual Report, the individual receiving the highest radiation dose through the air inhalation pathway was located northeast of RFETS and northwest of Great Western Reservoir. Since surface water is preferentially released to the east of RFETS and the surface soils east of RFETS contain elevated concentrations of radioactive material, the four locations east of RFETS were investigated along with the location northeast of RFETS to determine the MEI individual. After assessing the radiation dose to an individual at all five locations, the MEI individual for CY 1998 was located at Mower Lake.

To calculate radiation dose due to inhalation and ingestion, concentrations of radioactive material in air, water and soil are first multiplied by the amount of time the MEI is exposed to these media (i.e., 24 hrs/day, 350 days/yr, etc.) and then the intake rates (i.e., breathing rate, water ingestion rate, etc.) appropriate to the MEI individual. This product is the total amount of radioactive material inhaled and ingested by the MEI individual. The total amount of radioactive material inhaled and ingested is then multiplied by the radiation dose conversion factors found in Federal Guidance Report No. 11, Limiting Values of Radionuclide Intake and Air Concentrations and Dose Conversion Factors for Inhalation, Submersion and Ingestion, to calculate the radiation dose to the MEI due to inhalation and ingestion of radioactive material.

To calculate radiation dose due to external irradiation, concentrations of radioactive material in soil are multiplied by the external radiation dose conversion factors found in Federal Guidance Report No. 12, External Exposure to Radionuclides in Air, Water and Soil.

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## 7.2 INDUSTRIAL AREA PERIMETER - RFCA NEW SOURCE DETECTION STATIONS

### Gaging Station GS10

#### IA IM/IRA Purpose

- Evaluate water quantity and quality leaving the IA and entering the Pond B-1 Bypass on South Walnut Creek

#### Location

- South Walnut Creek, above the Pond B-1 Bypass, co-located with SW023
- State Plane Coordinates E 2086741, N 750326 (approximate)

#### Drainage Characteristics

- The basin includes the central and southern portions of the IA (total of 172 acres, 78% impervious)
- Areas draining to this site 900, 800, 700, 600, 500, 400, 300, and 100

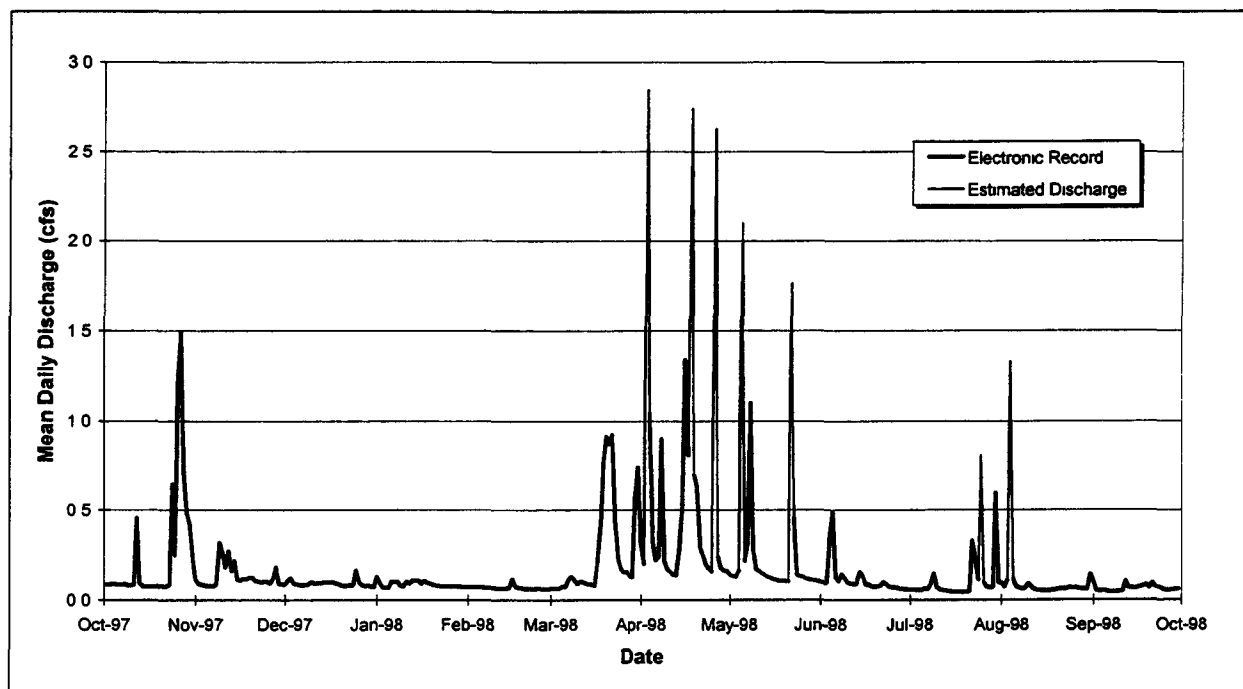


Figure 7-1 Gaging Station GS10 Mean Daily Discharge Hydrograph - Water Year 1998

## Gaging Station SW022

### IA IM/IRA Purpose

- Evaluate water quantity and quality flowing from the Central Avenue Ditch sub-basin comprising the majority of the IA south of Central Avenue

### Location

- Central Avenue Ditch at the splitter box near the Inner East Gate
- State Plane Coordinates E 2086443, N 749758 (surveyed)

### Drainage Characteristics

- The basin comprises the south central portion of the IA (total of 79 acres, 80% impervious)
- Areas draining to this site 100, 300, 400, 600, 800, and 900

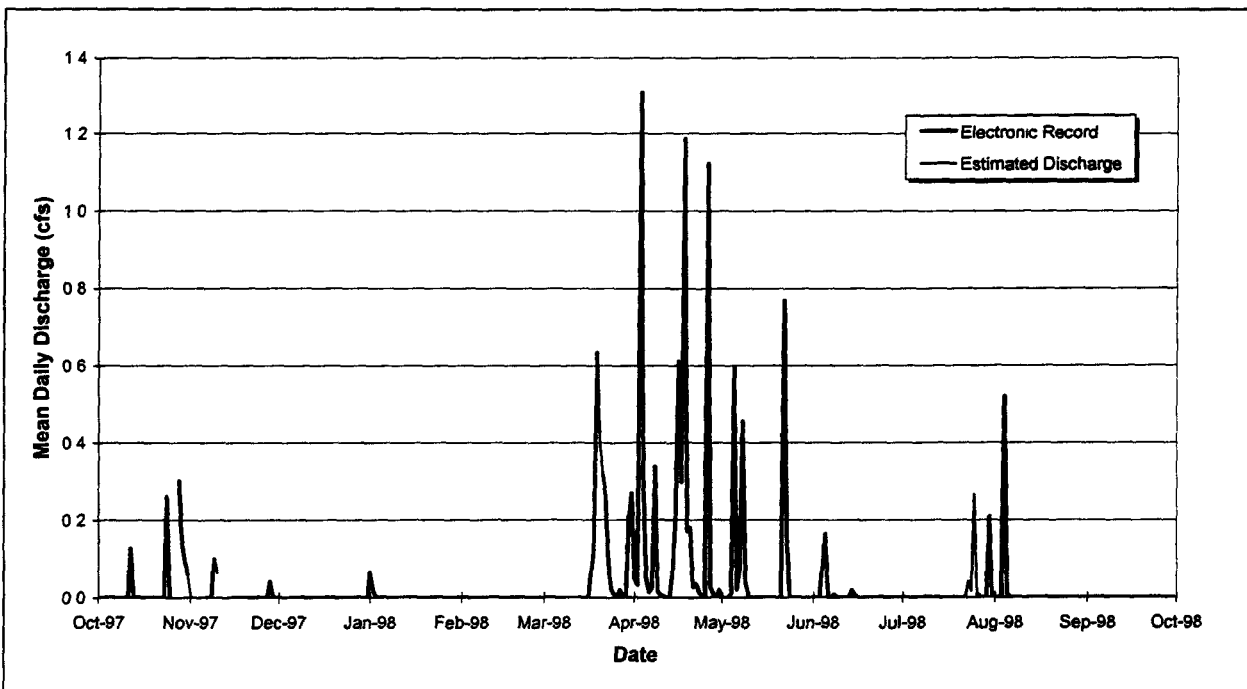


Figure 7-2 Gaging Station SW022 Mean Daily Discharge Hydrograph - Water Year 1998



## Gaging Station SW027

### IA IM/IRA Purpose

- Evaluate water quantity and quality flowing from the southern portion of the IA and the adjacent southern hillside into the South Interceptor Ditch (SID) and into Pond C-2

### Location

- SW027 lies on the South Interceptor Ditch at the upstream end of dual 66" corrugated metal pipes which convey SID water under Woman Creek and into Pond C-2
- State Plane Coordinates E 2088515, N 748067 (surveyed)

### Drainage Characteristics

- The basin consists of the southernmost portion of the IA and the sloping, vegetated buffer zone area south and southeast of the IA (total of 203 acres, 9% impervious)
- Areas draining to this site portions of the 400 and 800 Areas, plus the buffer zone

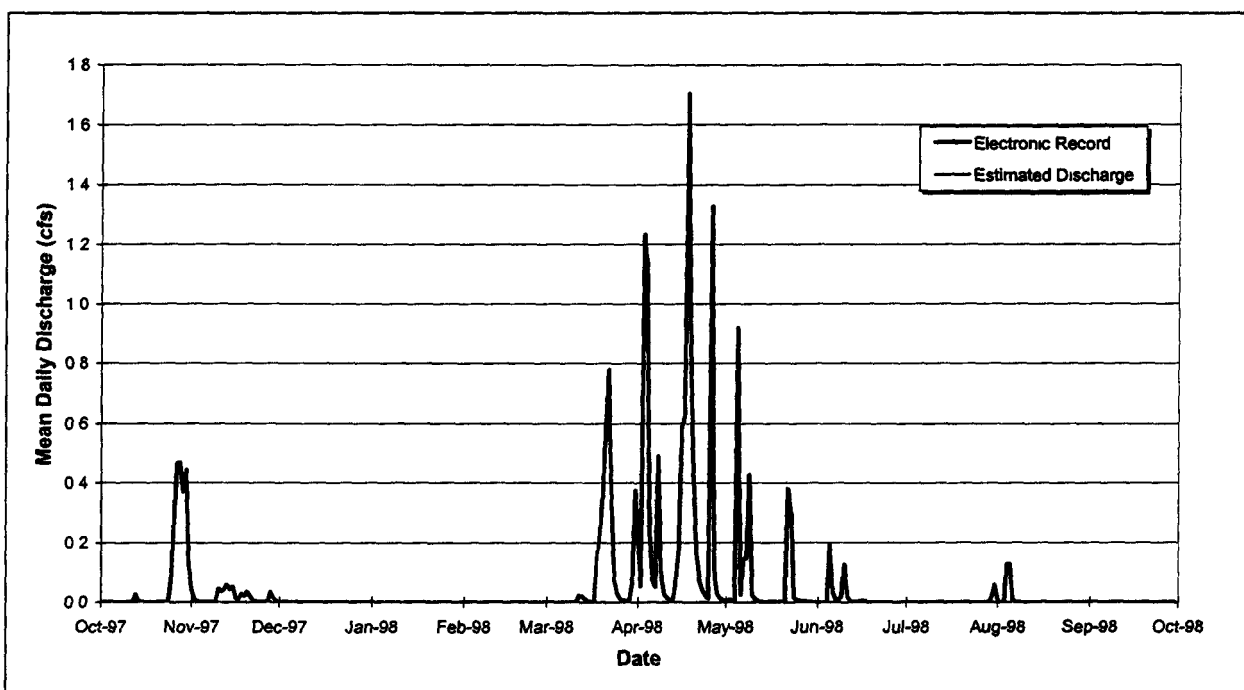


Figure 7-3 Gaging Station SW027 Mean Daily Discharge Hydrograph - Water Year 1998

## Gaging Station SW091

### IA IM/IRA Purpose

- Evaluate water quantity and quality leaving the IA from the basin that captures runoff immediately east of the Solar Ponds

### Location

- Small tributary of North Walnut Creek, which drains the northeast corner of the IA near the Solar Ponds
- State Plane Coordinates E 2086267, N 751777 (approximate)

### Drainage Characteristics

- The basin receives IA runoff from the open area immediately east of the Solar Ponds (approximately 17 acres, 50% impervious)

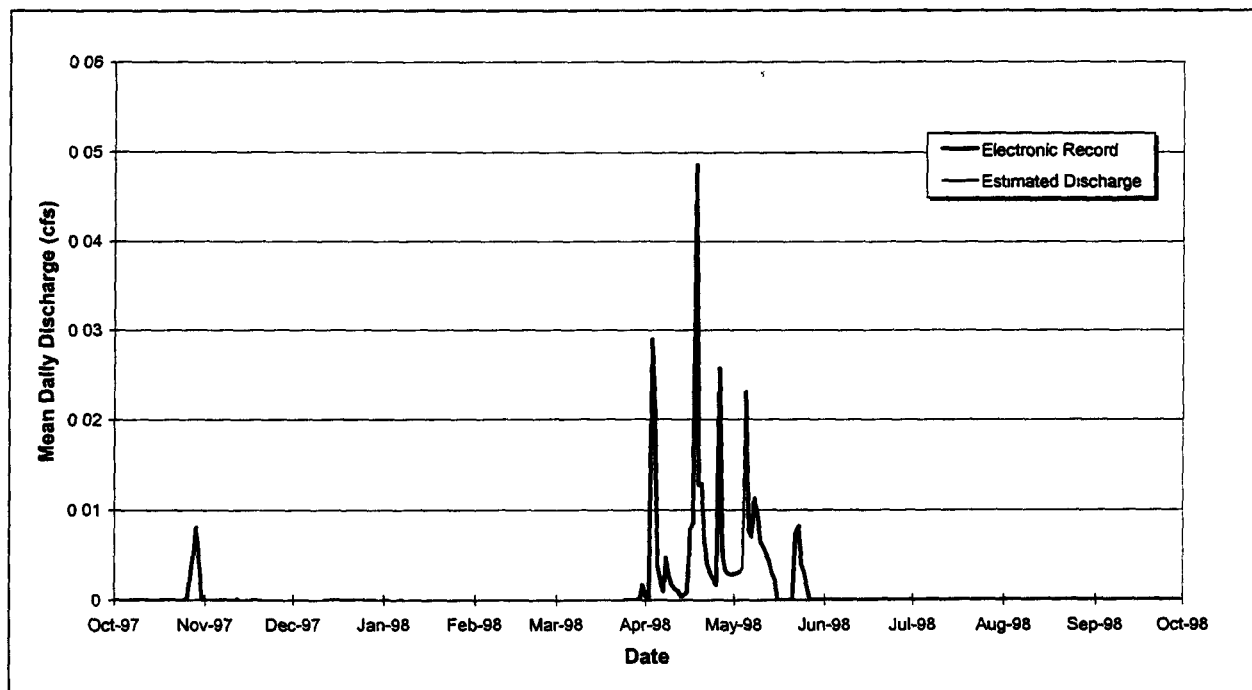


Figure 7-4 Gaging Station SW091 Mean Daily Discharge Hydrograph - Water Year 1998

## Gaging Station SW093

### IA IM/IRA Purpose

- Evaluate water quantity and quality leaving the north and northwest portions of the IA, including the northern half of the Protected Area

### Location

- North Walnut Creek below the 6-foot corrugated metal pipe draining the IA, directly north of Solar Pond 207C
- State Plane Coordinates E 2085008, N 751710 (surveyed)

### Drainage Characteristics

- The basin consists of the northern portion of the IA, and the buffer zone drainage immediately north of the IA (total of 219 acres, 47% impervious)
- Areas draining to this site portions of 100, 300, 500, and 700 Areas (plus buffer zone runoff)

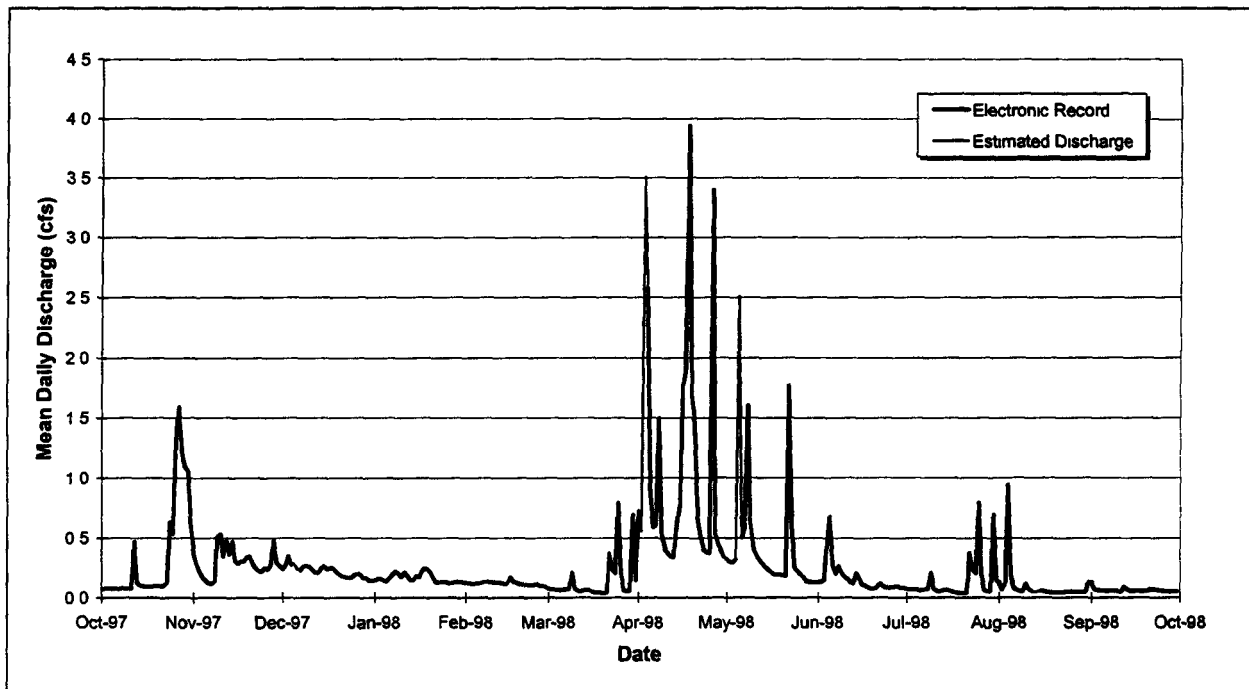


Figure 7-5 Gaging Station SW093 Mean Daily Discharge Hydrograph – Water Year 1998

### 7.3 INDUSTRIAL AREA INTERIOR - RFCA PERFORMANCE MONITORING STATIONS

#### Gaging Station GS27

##### IA IM/IRA Purpose

- Evaluate water quantity and quality flowing from the western portion of the (former) Building 889 drainage basin. Demolition of Building 889 was completed in FY96

##### Location

- Sited in small drainage ditch NW of Building 884
- State Plane Coordinates E 2083703, N 749242 (approximate)

##### Drainage Characteristics

- GS27 monitors a small ditch which outfalls to the Central Avenue Ditch northwest of Building 884. Surface water at this site originates as runoff from the areas north and west of 889 and surrounding 884 (approximately 0.4 acres, 30% impervious)
- Buildings within drainage basin: 884 and former sites of 889 and T889A (prior to D&D)

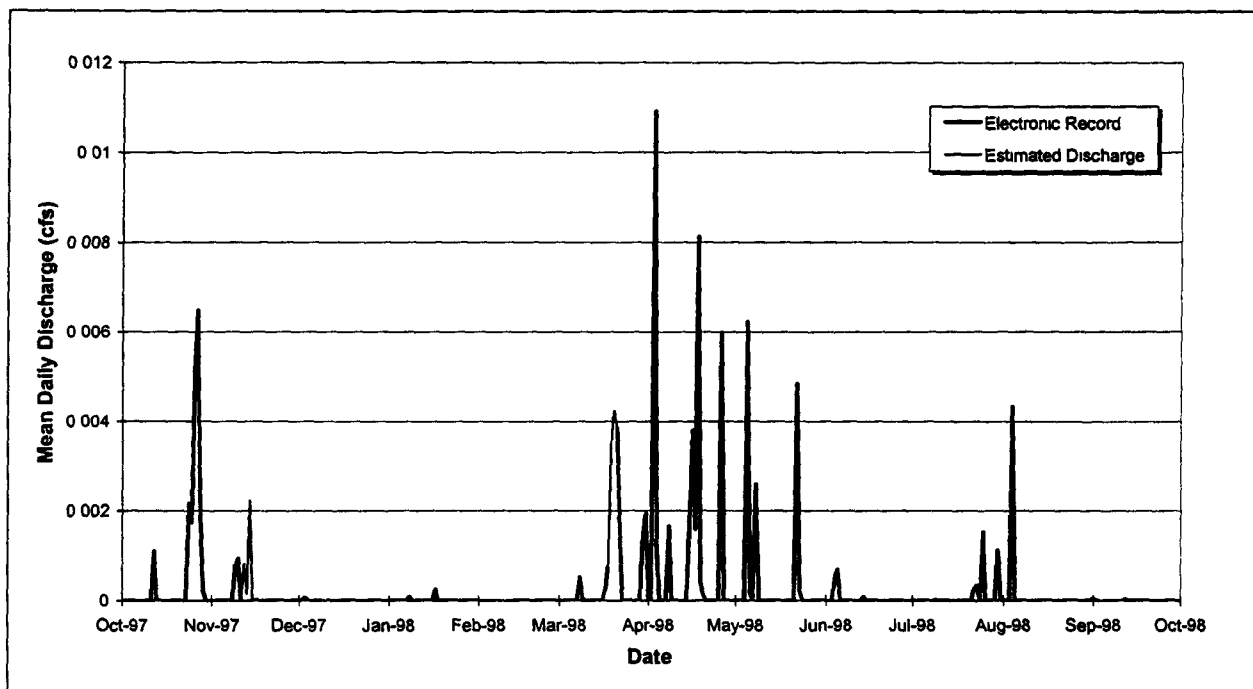


Figure 7-6 Gaging Station GS27 Mean Daily Discharge Hydrograph - Water Year 1998

- The highest mean Am activity at a single monitoring station during WY98 was 3 426 pCi/l for samples collected at station GS27 This compares to the historic mean for GS27 of 4 344 pCi/l Am dating back to October 1995

## Gaging Station GS32

### IA IM/IRA Purpose

- Evaluate water quality flowing from the IA basin that captures runoff from the area surrounding the Building 779 cluster Flow is not measured at this location

### Location

- Sited at the north end of the culvert that runs downhill north of Solar Pond 207A
- State Plane Coordinates E 2084700, N 751262 (approximate)

### Drainage Characteristics

- Description GS32 monitors a corrugated metal pipe which daylights immediately south of the patrol road within the Protected Area north of Solar Pond 207A Surface water at this site originates as runoff from area surrounding Building 779 (approximately 70 acres, 85% impervious)
- Buildings within drainage basin 705, 706, T706A, 727, 729, 779, T779A, 780, 780A, 780B, 782, 783, 784, 785, 786, and 787

Table 7-7 Gaging Station GS32 Radionuclide Summary Statistics - Water Year 1998

Analyte	Historical					
	Mean (pCi/l)	Max (pCi/l)	N	Std Deviation (pCi/l)	M2SD (pCi/l)	Dates
Americium-241	0.749	3.54	18	1.052	2.853	4/97-9/98
Plutonium-239,240	1.413	6.97	18	1.940	5.293	4/97-9/98
Total Uranium	1.096	2.788	18	0.829	2.754	4/97-9/98
Analyte	Water Year 1998					
	Mean (pCi/l)	Max (pCi/l)	N	# greater than M2SD	Result (pCi/l) / dates of samples greater than M2SD	
Americium-241	0.832	3.26	9	1	3.26, 5/22/98	
Plutonium-239,240	1.762	6.97	9	1	6.97, 5/22/98	
Total Uranium	0.987	2.788	9	1	2.788, 5/22/98	

### Notes

N = number of samples

M2SD = historical mean + 2 standard deviations

## Gaging Station GS37

### IA IM/IRA Purpose

- Evaluate water quantity and quality flowing from the basin that includes Building 123  
Demolition of Building 123 was completed in FY98

### Location

- Sited on Central Avenue Ditch north of Building 443

State Plane Coordinates E 2082076, N 749284 (approximate)

### Drainage Characteristics

- Description GS37 monitors surface water which originates as runoff from areas including Building 123 (approximately 8.6 acres)
- Areas included in the drainage basin 100 and 400

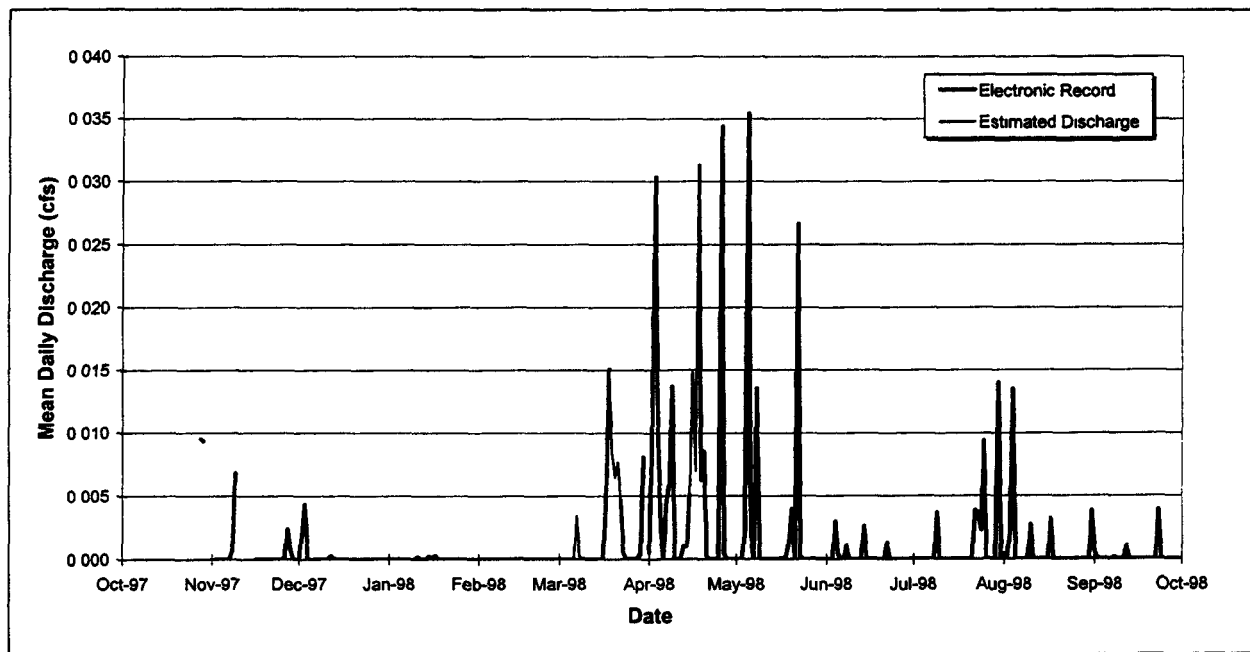


Figure 7-7 Gaging Station GS37 Mean Daily Discharge Hydrograph - Water Year 1998

## Gaging Station GS39

### IA IM/IRA Purpose

- Evaluate water quantity and quality flowing from portions of the 903 Pad, 904 Pad, and Contractor Yard

### Location

- Sited at a small culvert north of the 904 Pad
- State Plane Coordinates E 2085174 , N 749286 (approximate)

### Drainage Characteristics

- Description GS39 monitors a small ditch immediately north of the 904 Pad just upstream of the Central Avenue Ditch. Surface water at this site originates as runoff from area surrounding the 903 Pad, 904 Pad, and Contractor Yard (approximately 80 acres)

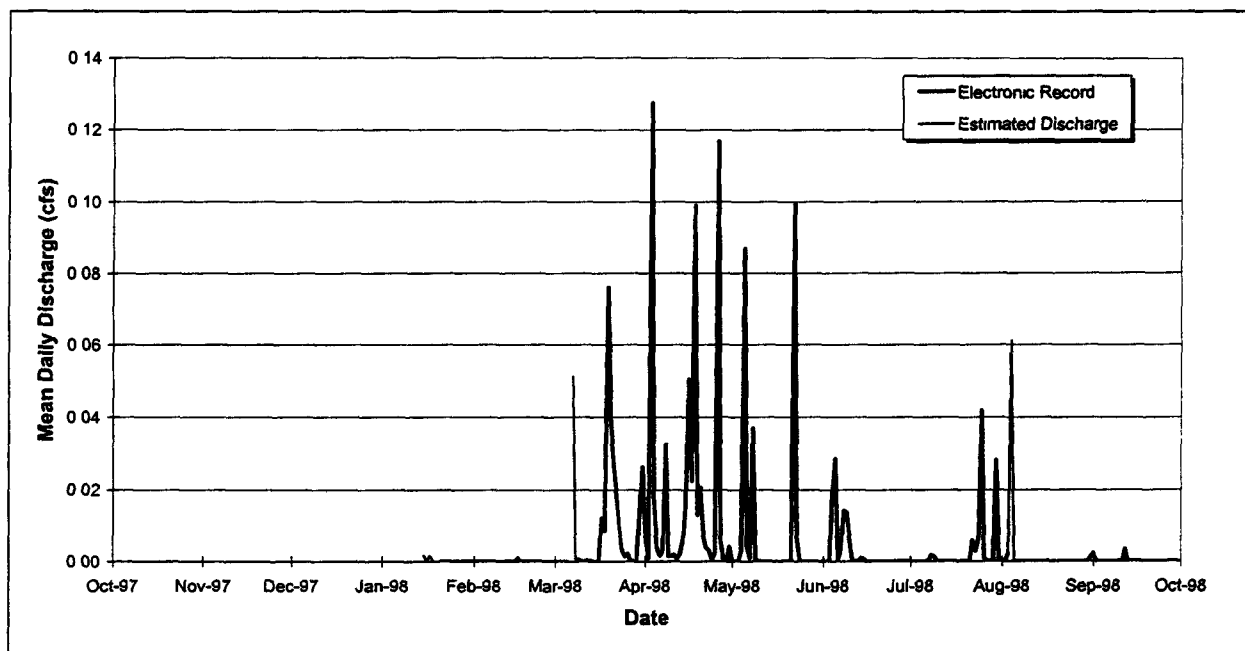


Figure 7-8 Gaging Station GS39 Mean Daily Discharge Hydrograph - Water Year 1998



## Gaging Station GS40

### IA IM/IRA Purpose

- Evaluate water quantity and quality flowing from the PA basin that captures runoff from portions of the 700 and 500 Areas

### Location

- Sited on South Walnut Creek on a concrete outfall apron east of the 750 Pad
- State Plane Coordinates E 2084748, N 749937 (approximate)

### Drainage Characteristics

- Description GS40 monitors surface water that originates as runoff from a portion of the 700 and 500 Areas within the PA (approximately 21.6 acres)
- Buildings within drainage basin 776, 777, 778, 707, 750, 750 Pad, T750, T764, 764, 765, 708, 709, 711, 569, 564, and 561

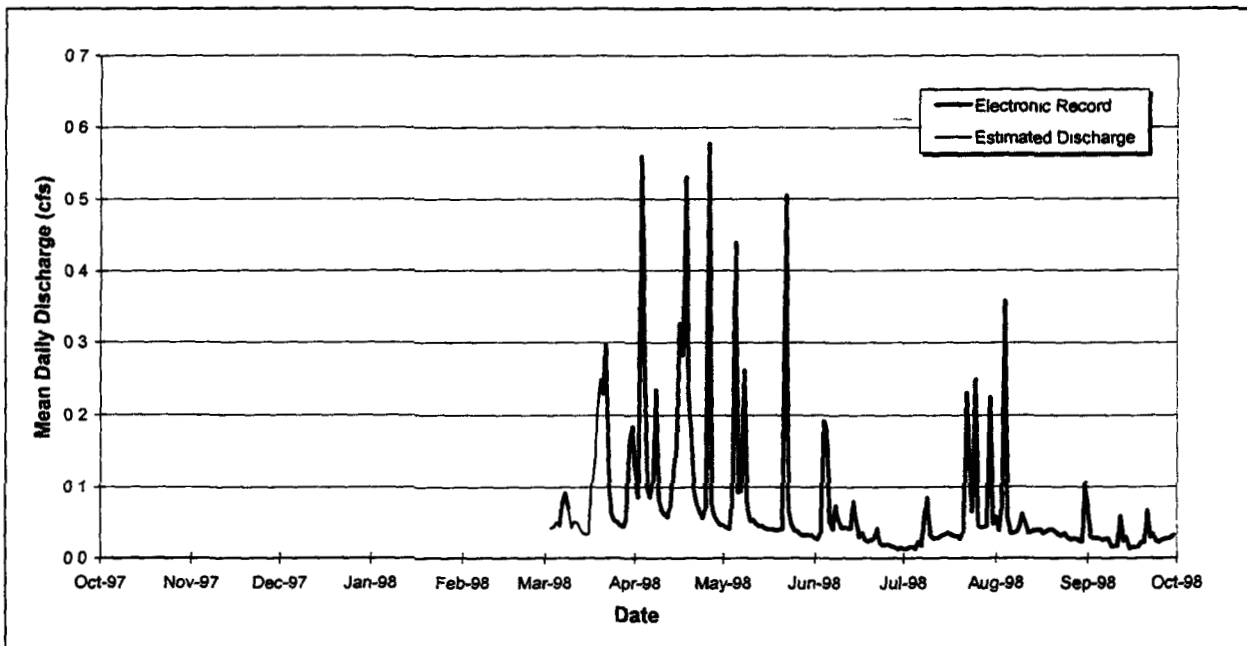


Figure 7-9 Gaging Station GS40 Mean Daily Discharge Hydrograph - Water Year 1998

#### **7 4 DAILY MEAN DISCHARGE TABLES**

The following tables for locations GS10, SW022, SW091, SW093, GS27, GS37, GS39, and GS40 are statistical summaries of monthly mean discharge data, annual discharge data, and runoff data for Water Year (WY) 1998. These data have been previously published in their respective quarters through out WY 1998 in this Quarterly Environmental Monitoring Report.

Daily mean discharges are computed by averaging the individual discharge measurements using the stage-discharge curves or tables. For some gaging stations, formation of ice in the winter can obscure the stage-discharge relations so that daily mean discharges need to be estimated from other information, such as temperature and precipitation records, notes of observations, or records from other gaging stations in the same or nearby basins for comparable periods. For most gaging stations, there might be periods when no gage-height record is obtained or the recorded gage height is so faulty that it cannot be used to compute daily mean discharge. This record loss occurs when recording instruments malfunction or otherwise fails to operate properly, intakes are plugged, the stilling well is frozen, or various other reasons. For such periods, the daily discharges are estimated from the recorded range in stage, previous or following record, discharge measurements, climatological records, or comparison with other gaging-stations records from the same or nearby basins.

Table 7-12 Gaging Station SW022 Mean Daily Discharge (Cubic Feet per Second) and Discharge Summaries for Water Year 1998

Day	October-97	November-97	December-97	January-98	February-98	March-98	April-98	May-98	June-98	July-98	August-98	September-98
1	0.000	0.000	0.000	0.066	0.000	0.000	0.050	0.000	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.016	0.000	0.000	0.033	0.000	0.000	0.000	0.000	0.000
3	0.000	WR	0.000	0.000	0.000	0.000	1.308	0.000	0.000	0.000	0.005	0.000
4	0.000	0.000	0.000	0.000	0.000	0.000	0.304	0.008	0.081	0.000	0.520	0.000
5	0.000	0.000	0.000	0.000	0.000	0.000	0.053	0.598	0.164	0.000	0.007	0.000
6	0.000	0.000	0.000	0.000	0.000	0.000	0.014	0.021	0.001	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000	0.000	0.000	0.025	0.067	0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000	0.000	0.000	0.339	0.455	0.008	0.000	0.000	0.000
9	0.000	0.101	0.000	0.000	0.000	0.000	0.015	0.042	0.001	0.002	0.000	0.000
10	0.000	0.064	0.000	0.000	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000
11	0.000	WR	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000
12	0.128	WR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
13	0.000	WR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000	0.000	0.000	0.056	0.000	0.019	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000	0.000	0.000	0.201	0.000	0.005	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000	0.000	0.000	0.611	0.000	0.000	0.000	0.000	0.000
17	0.000	0.000	0.000	0.000	0.000	0.062	0.299	0.000	0.000	0.000	0.000	0.000
18	0.000	0.000	0.000	0.000	0.000	0.122	1.187	0.000	0.000	0.000	0.000	0.000
19	0.000	0.000	0.000	0.000	0.000	0.634	0.171	0.000	0.000	0.000	0.000	0.000
20	0.000	0.000	0.000	0.000	0.000	0.393	0.180	0.000	0.000	0.000	0.000	0.000
21	0.000	0.000	0.000	0.000	0.000	0.322	0.027	0.000	0.000	0.000	0.000	0.000
22	0.000	0.000	0.000	0.000	0.000	0.266	0.037	0.769	0.000	0.003	0.000	0.000
23	0.000	0.000	0.000	0.000	0.000	0.087	0.014	0.147	0.000	0.043	0.000	0.000
24	0.260	0.002	0.000	0.000	0.000	0.020	0.003	0.000	0.000	0.017	0.000	0.000
25	0.000	0.000	0.000	0.000	0.000	0.007	0.000	0.000	0.000	0.267	0.000	0.000
26	WR	0.000	0.000	0.000	0.000	0.004	1.123	0.000	0.000	0.008	0.000	0.000
27	WR	0.000	0.000	0.000	0.000	0.020	0.028	0.000	0.000	0.000	0.000	0.000
28	0.303	0.041	0.000	0.000	0.000	0.001	0.003	0.000	0.000	0.000	0.000	0.000
29	0.148	0.000	0.000	0.000	NA	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	0.084	0.000	0.000	0.000	NA	0.205	0.021	0.000	0.000	0.210	0.000	0.000
31	0.060	NA	0.000	0.000	NA	0.271	NA	0.000	NA	0.002	0.000	NA
Monthly Average	0.034	0.008	0.000	0.003	0.000	0.078	0.204	0.068	0.009	0.018	0.017	0.000

## Monthly Discharge

Cubic Feet	85934	18073	0	7036	25	208437	527994	182023	23966	47678	45984	0
Gallons	642827	135199	0	52631	185	1559219	3949668	1361628	178279	356653	343983	0
Acre-Feet	1.97	0.41	0.00	0.16	0.00	4.78	12.12	4.18	0.55	1.09	1.06	0.00

## Annual Summaries for WY98

Partial Data	0.037
Partial Data	16.60
Partial Data	1147149
Partial Data	8581273
Partial Data	26.33

KEY WR No data or poor data due to winter icing conditions

BD Bad data due to equipment failures

ITALICS Italic values contain data estimated from field observations and record at adjacent or comparable gages

*Rocky Flats Environmental Technology Site - Quarterly Environmental Monitoring Report April - June 1999*  
**Table 7-14 Gaging Station SW093 Mean Daily Discharge (Cubic Feet per Second) and Discharge Summaries for Water Year 1998**

Day	October-97	November-97	December-97	January-98	February-98	March-98	April-98	May-98	June-98	July-98	August-98	September-98
1	0.075	0.371	0.240	0.145	0.124	0.073	0.724	0.320	0.125	0.073	0.125	0.130
2	0.076	0.278	0.271	0.158	0.120	0.068	0.558	0.298	0.131	0.088	0.067	0.070
3	0.080	0.219	0.349	0.156	0.114	0.069	3.509	0.292	0.147	0.069	0.112	0.065
4	0.078	0.167	0.272	0.142	0.116	0.068	2.581	0.317	0.437	0.088	0.943	0.060
5	0.075	0.139	0.266	0.136	0.119	0.060	0.905	2.512	0.677	0.080	0.173	0.058
6	0.074	0.121	0.239	0.168	0.119	0.067	0.591	0.503	0.268	0.067	0.081	0.057
7	0.071	0.113	0.231	0.197	0.129	0.069	0.607	0.576	0.196	0.069	0.066	0.057
8	0.079	0.132	0.258	0.222	0.130	0.072	1.498	1.604	0.266	0.072	0.053	0.060
9	0.075	0.510	0.268	0.202	0.135	0.209	0.535	0.643	0.209	0.209	0.057	0.055
10	0.075	0.531	0.258	0.173	0.131	0.074	0.404	0.420	0.172	0.074	0.117	0.053
11	0.075	0.341	0.228	0.214	0.129	0.057	0.372	0.360	0.154	0.057	0.072	0.051
12	0.474	0.484	0.208	0.181	0.128	0.050	0.345	0.319	0.128	0.050	0.057	0.091
13	0.125	0.362	0.210	0.144	0.121	0.059	0.335	0.280	0.118	0.059	0.047	0.070
14	0.104	0.472	0.243	0.146	0.117	0.068	0.599	0.260	0.208	0.068	0.051	0.057
15	0.097	0.305	0.264	0.181	0.116	0.062	0.767	0.235	0.159	0.062	0.058	0.055
16	0.091	0.284	0.238	0.170	0.171	0.051	1.761	0.211	0.109	0.051	0.057	0.055
17	0.088	0.306	0.251	0.220	0.133	0.047	1.912	0.193	0.103	0.047	0.049	0.056
18	0.092	0.306	0.246	0.244	0.124	0.043	3.944	0.189	0.088	0.043	0.044	0.057
19	0.097	0.340	0.217	0.239	0.112	0.040	1.668	0.190	0.076	0.040	0.043	0.057
20	0.101	0.347	0.195	0.206	0.108	0.039	1.458	0.186	0.076	0.039	0.045	0.057
21	0.100	0.278	0.180	0.158	0.110	0.041	0.680	0.181	0.084	0.041	0.048	0.073
22	0.100	0.243	0.171	0.127	0.108	0.372	0.501	1.766	0.122	0.372	0.047	0.069
23	0.122	0.226	0.164	0.128	0.104	0.234	0.396	0.617	0.101	0.234	0.045	0.086
24	0.636	0.226	0.166	0.130	0.106	0.201	0.377	0.250	0.079	0.201	0.052	0.063
25	0.533	0.248	0.169	0.134	0.114	0.782	0.367	0.220	0.083	0.792	0.052	0.056
26	1.320	0.235	0.198	0.121	0.096	0.188	3.403	0.194	0.090	0.188	0.050	0.053
27	1.593	0.274	0.194	0.121	0.089	0.062	0.528	0.188	0.091	0.062	0.048	0.053
28	1.242	0.480	0.167	0.125	0.091	0.055	0.440	0.138	0.097	0.056	0.047	0.050
29	1.094	0.291	0.168	0.130	NA	0.056	0.390	0.130	0.082	0.056	0.046	0.051
30	1.054	0.259	0.144	0.134	NA	0.696	0.339	0.127	0.084	0.696	0.046	0.050
31	0.610	NA	0.138	0.128	NA	0.145	NA	0.129	NA	0.145	0.127	NA
Monthly Average	0.339	0.296	0.221	0.164	0.119	0.135	1.083	0.446	0.159	0.135	0.094	0.062

**Monthly Discharge**

Cubic Feet	907511	768011	591817	438099	287162	361571	2807166	1195265	411286	361571	252494	160331
Gallons	6788653	5745124	4427103	3284692	2148123	2704738	20999064	8941204	3076832	2704738	1888786	1198380
Acre-Feet	20.83	17.63	13.58	10.08	6.59	8.30	64.43	27.44	9.44	8.30	5.80	3.68

**Annual Summaries for WY98**

ft <sup>3</sup> /Sec	0.271
GPM	121.59
Cubic Feet	8543286
Gallons	63908219
Acre-Feet	196.10

**KEY** WR No data or poor data due to winter icing conditions

BD Bad data due to equipment failures

ITALICS Italic values contain data estimated from field observations and record at adjacent or comparable gages

**Table 7-16 Gaging Station GS37 Mean Daily Discharge (Cubic Feet per Second) and Discharge Summaries for Water Year 1998**

Day	October-87	November-87	December-87	January-88	February-88	March-88	April-88	May-88	June-88	July-88	August-88	September-88
1	No Data	BD	0 000	0 000	0 000	0 000	0 001	0 000	0 000	0 000	0 000	0 001
2	No Data	0 000	0 002	0 000	0 000	0 000	0 008	0 000	0 000	0 000	0 000	0 000
3	No Data	0 000	0 004	0 000	0 000	0 000	0 030	0 000	0 000	0 000	0 002	0 000
4	No Data	0 000	0 000	0 000	0 000	0 000	0 011	0 002	0 003	0 000	0 013	0 000
5	No Data	0 000	0 000	0 000	0 000	0 000	0 002	0 035	0 000	0 000	0 000	0 000
6	No Data	0 000	0 000	0 000	0 000	0 000	0 000	0 002	0 000	0 000	0 000	0 000
7	No Data	0 000	0 000	0 000	0 000	0 003	0 004	0 000	0 000	0 000	0 000	0 000
8	No Data	0 001	0 000	0 000	0 000	0 000	0 006	0 014	0 001	0 000	0 000	0 000
9	No Data	0 007	0 000	0 000	0 000	0 000	0 014	0 000	0 000	0 004	0 000	0 000
10	No Data	WR	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 003	0 000
11	No Data	WR	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000
12	No Data	WR	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 001
13	No Data	0 000	0 000	0 000	0 000	0 000	0 001	0 000	0 000	0 000	0 000	0 000
14	No Data	WR	0 000	0 000	0 000	0 000	0 001	0 000	0 003	0 000	0 000	0 000
15	No Data	WR	0 000	0 000	0 000	0 000	0 005	0 000	0 000	0 000	0 000	0 000
16	No Data	0 000	0 000	0 000	0 000	0 000	0 015	0 000	0 000	0 000	0 000	0 000
17	No Data	0 000	0 000	0 000	0 000	0 004	0 007	0 000	0 000	0 000	0 003	0 000
18	No Data	0 000	0 000	0 000	0 000	0 015	0 031	0 000	0 000	0 000	0 000	0 000
19	No Data	0 000	0 000	0 000	0 000	0 008	0 006	0 001	0 000	0 000	0 000	0 000
20	No Data	0 000	0 000	0 000	0 000	0 006	0 009	0 004	0 000	0 000	0 000	0 000
21	No Data	0 000	0 000	0 000	0 000	0 008	0 000	0 000	0 000	0 000	0 000	0 000
22	No Data	0 000	0 000	0 000	0 000	0 005	0 000	0 027	0 001	0 004	0 000	0 000
23	No Data	0 000	0 000	0 000	0 000	0 001	0 000	0 000	0 000	0 004	0 000	0 004
24	No Data	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 002	0 000	0 000
25	No Data	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 009	0 000	0 000
26	No Data	0 000	0 000	0 000	0 000	0 000	0 034	0 000	0 000	0 000	0 000	0 000
27	No Data	0 002	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000
28	0 010	0 001	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000
29	0 009	0 000	0 000	0 000	NA	0 000	0 000	0 000	0 000	0 000	0 000	0 000
30	BD	0 000	0 000	0 000	NA	0 008	0 000	0 000	0 000	0 014	0 000	0 000
31	BD	NA	0 000	0 000	NA	WR	NA	0 000	NA	0 000	0 004	NA
Monthly Average	0 009	0 000	0 000	0 000	0 000	0 002	0 006	0 003	0 000	0 001	0 001	0 000
Partial Data												

[illegible]

## Annual Summaries for WY98

0.001	Partial Delta
0.61	
38522	
288167	
0.88	

**KEY** WR No data or poor data due to winter icing conditions

BD Bad data due to equipment failures

**ITALICS** Italic values contain data estimated from field observations and record at adjacent or comparable gages

Rocky Flats Environmental Technology Site - Quarterly Environmental Monitoring Report April - June 1999  
 Table 7-18 Gaging Station GS40 Mean Daily Discharge (Cubic Feet per Second) and Discharge Summaries for Water Year 1998

Day	October-97	November-97	December-97	January-98	February-98	March 98	April-98	May-98	June-98	July-98	August-98	September-98
1	No Data	No Data	No Data	No Data	No Data	No Data	0.126	0.046	0.029	0.013	0.058	0.072
2	No Data	No Data	No Data	No Data	No Data	No Data	0.086	0.043	0.027	0.012	0.038	0.030
3	No Data	No Data	No Data	No Data	No Data	No Data	0.560	0.041	0.036	0.015	0.068	0.028
4	No Data	No Data	No Data	No Data	No Data	0.043	0.308	0.077	0.192	0.016	0.358	0.028
5	No Data	No Data	No Data	No Data	No Data	0.051	0.102	0.440	0.177	0.012	0.056	0.027
6	No Data	No Data	No Data	No Data	No Data	0.046	0.086	0.093	0.050	0.023	0.035	0.028
7	No Data	No Data	No Data	No Data	No Data	0.078	0.108	0.094	0.040	0.017	0.035	0.027
8	No Data	No Data	No Data	No Data	No Data	0.092	0.236	0.261	0.074	0.054	0.036	0.028
9	No Data	No Data	No Data	No Data	No Data	0.069	0.088	0.078	0.054	0.085	0.043	0.016
10	No Data	No Data	No Data	No Data	No Data	0.043	0.068	0.052	0.042	0.033	0.062	0.017
11	No Data	No Data	No Data	No Data	No Data	0.051	0.061	0.054	0.043	0.028	0.050	0.017
12	No Data	No Data	No Data	No Data	No Data	0.050	0.057	0.048	0.043	0.029	0.036	0.059
13	No Data	No Data	No Data	No Data	No Data	0.041	0.075	0.045	0.042	0.029	0.036	0.024
14	No Data	No Data	No Data	No Data	No Data	0.035	0.124	0.045	0.080	0.032	0.039	0.029
15	No Data	No Data	No Data	No Data	No Data	0.033	0.157	0.041	0.051	0.033	0.040	0.013
16	No Data	No Data	No Data	No Data	No Data	0.034	0.327	0.041	0.030	0.036	0.040	0.016
17	No Data	No Data	No Data	No Data	No Data	0.101	0.282	0.041	0.036	0.033	0.034	0.016
18	No Data	No Data	No Data	No Data	No Data	0.133	0.531	0.039	0.025	0.031	0.037	0.016
19	No Data	No Data	No Data	No Data	No Data	0.215	0.226	0.040	0.023	0.031	0.039	0.022
20	No Data	No Data	No Data	No Data	No Data	0.249	0.171	0.040	0.026	0.027	0.040	0.021
21	No Data	No Data	No Data	No Data	No Data	0.230	0.097	0.041	0.028	0.037	0.037	0.067
22	No Data	No Data	No Data	No Data	No Data	0.297	0.075	0.505	0.042	0.231	0.033	0.029
23	No Data	No Data	No Data	No Data	No Data	0.115	0.065	0.073	0.023	0.130	0.031	0.034
24	No Data	No Data	No Data	No Data	No Data	0.062	0.056	0.048	0.018	0.065	0.035	0.024
25	No Data	No Data	No Data	No Data	No Data	0.052	0.069	0.039	0.019	0.249	0.030	0.023
26	No Data	No Data	No Data	No Data	No Data	0.050	0.578	0.038	0.019	0.045	0.028	0.028
27	No Data	No Data	No Data	No Data	No Data	0.045	0.076	0.034	0.016	0.042	0.027	0.026
28	No Data	No Data	No Data	No Data	No Data	0.044	0.058	0.032	0.015	0.044	0.027	0.027
29	No Data	No Data	No Data	No Data	NA	0.054	0.051	0.033	0.013	0.044	0.025	0.028
30	No Data	No Data	No Data	No Data	NA	0.158	0.047	0.032	0.016	0.225	0.023	0.032
31	No Data	NA	No Data	No Data	NA	0.184	NA	0.033	NA	0.047	0.105	NA
Monthly Average						0.095	0.165	0.083	0.044	0.056	0.051	0.028

Partial Data

Monthly Discharge

Cubic Feet	226716	427093	221944	114705	151034	136611	73135
Gallons	1718395	3194879	1660257	858054	1128814	1021920	547088
Acre-Feet	5.27	9.80	5.09	2.63	3.47	3.14	1.68

Partial Data

Annual Summaries for WY98

FT <sup>3</sup> /Sec	0.074
GPM	33.34
Cubic Feet	1354238
Gallons	10130408
Acre-Feet	31.08

Partial Data

KEY WR No data or poor data due to winter icing conditions

BD Bad data due to equipment failures

ITALICS Italic values contain data estimated from field observations and record at adjacent or comparable gages

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Rocky Flats Environmental Technology Site - Quarterly Environmental Monitoring Report April - June 1999  
 Table 7-17 Gaging Station GS39 Mean Daily Discharge (Cubic Feet per Second) and Discharge Summaries for Water Year 1998

Day	October-97	November-97	December-97	January-98	February-98	March-98	April-98	May-98	June-98	July-98	August-98	September-98
1	No Data	No Data	No Data	No Data	0.000	0.000	0.008	0.000	0.000	0.000	0.000	0.002
2	No Data	No Data	No Data	No Data	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
3	No Data	No Data	No Data	No Data	0.000	0.000	0.127	0.000	0.000	0.000	0.002	0.000
4	No Data	No Data	No Data	No Data	0.000	0.000	0.017	0.003	0.020	0.000	0.061	0.000
5	No Data	No Data	No Data	No Data	0.000	0.000	0.004	0.087	0.029	0.000	0.000	0.000
6	No Data	No Data	No Data	No Data	0.000	WR	0.002	0.004	0.000	0.000	0.000	0.000
7	No Data	No Data	No Data	No Data	0.000	0.051	0.003	0.001	0.003	0.000	0.000	0.000
8	No Data	No Data	No Data	No Data	0.000	0.001	0.033	0.037	0.014	0.002	0.000	0.000
9	No Data	No Data	No Data	No Data	0.000	0.001	0.002	0.001	0.014	0.001	0.000	0.000
10	No Data	No Data	No Data	No Data	0.000	0.000	0.001	0.000	0.008	0.000	0.000	0.000
11	No Data	No Data	No Data	No Data	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000
12	No Data	No Data	No Data	No Data	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.004
13	No Data	No Data	No Data	No Data	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000
14	No Data	No Data	No Data	No Data	0.000	0.000	0.005	0.000	0.001	0.000	0.000	0.000
15	No Data	No Data	No Data	0.002	0.000	0.000	0.015	0.000	0.001	0.000	0.000	0.000
16	No Data	No Data	No Data	0.000	0.001	0.000	0.051	0.000	0.000	0.000	0.000	0.000
17	No Data	No Data	No Data	0.002	0.000	0.012	0.022	0.000	0.000	0.000	0.000	0.000
18	No Data	No Data	No Data	0.000	0.000	0.009	0.089	0.000	0.000	0.000	0.000	0.000
19	No Data	No Data	No Data	WR	0.000	0.076	0.013	0.000	0.000	0.000	0.000	0.000
20	No Data	No Data	No Data	WR	0.000	0.039	0.021	0.000	0.000	0.000	0.000	0.000
21	No Data	No Data	No Data	0.000	0.000	0.026	0.007	0.000	0.000	0.000	0.000	0.000
22	No Data	No Data	No Data	0.000	0.000	0.018	0.004	0.099	0.000	0.006	0.000	0.000
23	No Data	No Data	No Data	0.000	0.000	0.009	0.003	0.007	0.000	0.003	0.000	0.000
24	No Data	No Data	No Data	0.000	0.000	0.003	0.001	0.000	0.000	0.006	0.000	0.000
25	No Data	No Data	No Data	0.000	0.000	0.001	0.002	0.000	0.000	0.042	0.000	0.000
26	No Data	No Data	No Data	0.000	0.000	0.002	0.117	0.000	0.000	0.001	0.000	0.000
27	No Data	No Data	No Data	0.000	0.000	0.000	0.007	0.000	0.000	0.000	0.000	0.000
28	No Data	No Data	No Data	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
29	No Data	No Data	No Data	0.000	NA	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	No Data	No Data	No Data	0.000	NA	0.013	0.004	0.000	0.000	0.028	0.000	0.000
31	No Data	NA	No Data	0.000	NA	0.026	NA	0.000	NA	0.000	0.001	NA
Monthly Average				0.000	0.000	0.010	0.019	0.008	0.003	0.003	0.002	0.000

Partial Data

Monthly Discharge

Cubic Feet				303	90	25157	49542	20672	7536	7735	5595	522
Gallons				2270	677	188188	370599	154634	56373	57864	41853	3905
Acre-Feet				0.01	0.00	0.58	1.14	0.47	0.17	0.18	0.13	0.01

Partial Data

Annual Summaries for WY98

Ft/Sec	0.005
GPM	2.38
Cubic Feet	117153
Gallons	876362
Acre-Feet	2.69

Partial Data

KEY WR No data or poor data due to winter icing conditions

BD Bad data due to equipment failures

ITALICS Italic values contain data estimated from field observations and record at adjacent or comparable gages



Table 7-15 Gaging Station GS27 Mean Daily Discharge (Cubic Feet per Second) and Discharge Summaries for Water Year 1998

Day	October-97	November-97	December-97	January-98	February-98	March-98	April-98	May-98	June-98	July-98	August-98	September-98
1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0109	0.0000	0.0000	0.0000	0.0000	0.0000
4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0000	0.0005	0.0000	0.0043	0.0000
5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0062	0.0007	0.0000	0.0000	0.0000
6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000	0.0000	0.0000
7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
8	0.0000	0.0000	0.0000	0.0001	0.0000	0.0005	0.0017	0.0026	0.0000	0.0000	0.0000	0.0000
9	0.0000	0.0008	0.0000	0.0000	BD	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10	0.0000	0.0009	BD	0.0000	BD	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.0011	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
13	0.0000	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
14	0.0000	0.0022	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000
15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0016	0.0000	0.0000	0.0000	0.0000	0.0000
16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0038	0.0000	0.0000	0.0000	0.0000	0.0000
17	0.0000	0.0000	0.0000	0.0003	0.0000	0.0002	0.0016	0.0000	0.0000	0.0000	0.0000	0.0000
18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0081	0.0000	0.0000	0.0000	0.0000	0.0000
19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0035	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000
20	0.0000	0.0000	0.0000	0.0000	0.0000	0.0042	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
21	0.0000	0.0000	0.0000	0.0000	0.0000	0.0039	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
22	0.0000	0.0000	0.0000	0.0000	0.0000	0.0015	0.0000	0.0049	0.0000	0.0003	0.0000	0.0000
23	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000	0.0003	0.0000	0.0000
24	0.0022	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
25	0.0017	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0015	0.0000	0.0000
26	0.0052	0.0000	0.0000	0.0000	0.0000	0.0000	0.0060	0.0000	0.0000	0.0000	0.0000	0.0000
27	0.0085	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
28	0.0019	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
29	0.0002	0.0000	0.0000	0.0000	NA	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
30	0.0000	0.0000	0.0000	0.0000	NA	0.0015	0.0000	0.0000	0.0000	0.0011	0.0000	0.0000
31	0.0000	NA	0.0000	0.0000	NA	0.0019	NA	0.0000	NA	0.0000	0.0000	NA
Monthly Average	0.001	0.000	0.000	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.000

Partial Data

Partial Data

Monthly Discharge

Cubic Feet	1628	427	6	32	0	1558	3048	1222	111	284	376	7
Gallons	12180	3191	43	240	0	11652	22786	9139	830	2125	2809	53
Acre Feet	0.04	0.01	0.00	0.00	0.00	0.04	0.07	0.03	0.00	0.01	0.01	0.00

Partial Data

Partial Data

Annual Summaries for WY98

Ft <sup>3</sup> /Sec	0.0003
GPM	0.12
Cubic Feet	8695
Gallons	65046
Acre Feet	0.20

Partial Data

KEY WR No data or poor data due to winter icing conditions

BD Bad data due to equipment failures

ITALICS Italic values contain data estimated from field observations and record at adjacent or comparable gages

*Rocky Flats Environmental Technology Site - Quarterly Environmental Monitoring Report April - June 1999*

**Table 7-13 Gaging Station SW091 Mean Daily Discharge (Cubic Feet per Second) and Discharge Summaries for Water Year 1998**

Day	October-97	November-97	December-97	January-98	February-98	March-98	April-98	May-98	June-98	July-98	August-98	September-98
1	0.0000	0.0000	WR	0.0000	WR	WR	0.0004	0.0029	0.0000	0.0000	0.0000	0.0000
2	0.0000	0.0000	WR	0.0000	WR	WR	0.0003	0.0029	0.0000	0.0000	0.0000	0.0000
3	0.0000	0.0000	WR	WR	WR	WR	0.0290	0.0031	0.0000	0.0000	0.0000	0.0000
4	0.0000	0.0000	WR	WR	WR	WR	0.0209	0.0035	0.0000	0.0000	0.0000	0.0000
5	0.0000	0.0000	WR	WR	WR	WR	0.0038	0.0231	0.0000	0.0000	0.0000	0.0000
6	0.0000	0.0000	WR	0.0000	WR	WR	0.0021	0.0078	0.0000	0.0000	0.0000	0.0000
7	0.0000	0.0000	WR	0.0000	WR	WR	0.0009	0.0070	0.0000	0.0000	0.0000	0.0000
8	0.0000	0.0000	WR	WR	WR	WR	0.0047	0.0113	0.0000	0.0000	0.0000	0.0000
9	0.0000	0.0000	WR	WR	WR	WR	0.0023	0.0097	0.0000	0.0000	0.0000	0.0000
10	0.0000	0.0000	WR	WR	WR	WR	0.0016	0.0065	0.0000	0.0000	0.0000	0.0000
11	0.0000	0.0000	WR	WR	WR	WR	0.0012	0.0058	0.0000	0.0000	0.0000	0.0000
12	0.0000	0.0002	0.0000	WR	WR	WR	0.0010	0.0051	0.0000	0.0000	0.0000	0.0000
13	0.0000	0.0000	0.0000	WR	WR	WR	0.0004	0.0043	0.0000	0.0000	0.0000	0.0000
14	0.0000	WR	0.0000	WR	WR	WR	0.0005	0.0029	0.0000	0.0000	0.0000	0.0000
15	0.0000	0.0000	0.0000	WR	WR	WR	0.0008	0.0022	0.0000	0.0000	0.0000	0.0000
16	0.0000	0.0000	0.0000	WR	WR	WR	0.0077	0.0000	0.0000	0.0000	0.0000	0.0000
17	0.0000	0.0000	0.0000	WR	WR	WR	0.0086	0.0000	0.0000	0.0000	0.0000	0.0000
18	0.0000	0.0000	0.0000	WR	WR	WR	0.0465	0.0000	0.0000	0.0000	0.0000	0.0000
19	0.0000	0.0000	0.0000	WR	WR	WR	0.0128	0.0000	0.0000	0.0000	0.0000	0.0000
20	0.0000	0.0000	0.0000	WR	WR	WR	0.0129	0.0000	0.0000	0.0000	0.0000	0.0000
21	0.0000	WR	0.0000	WR	WR	WR	0.0063	0.0000	0.0000	0.0000	0.0000	0.0000
22	0.0000	0.0000	0.0000	WR	WR	WR	0.0040	0.0072	0.0000	0.0000	0.0000	0.0000
23	0.0000	WR	0.0000	WR	WR	WR	0.0028	0.0082	0.0000	0.0000	0.0000	0.0000
24	0.0000	WR	0.0000	WR	WR	WR	0.0022	0.0038	0.0000	0.0000	0.0000	0.0000
25	0.0000	WR	0.0000	WR	WR	0.0000	0.0016	0.0029	0.0000	0.0000	0.0000	0.0000
26	0.0002	WR	0.0000	WR	WR	0.0000	0.0257	0.0012	0.0000	0.0000	0.0000	0.0000
27	0.0030	WR	0.0000	WR	WR	0.0000	0.0052	0.0000	0.0000	0.0000	0.0000	0.0000
28	0.0050	WR	0.0000	WR	WR	0.0000	0.0032	0.0000	0.0000	0.0000	0.0000	0.0000
29	0.0081	WR	0.0000	WR	NA	0.0000	0.0029	0.0000	0.0000	0.0000	0.0000	0.0000
30	0.0045	WR	WR	WR	NA	0.0001	0.0028	0.0000	0.0000	0.0000	0.0000	0.0000
31	0.0000	NA	WR	WR	NA	0.0017	NA	0.0000	NA	0.0000	0.0000	NA
Monthly Average	0.001	0.000	0.000	0.000	0.000	0.000	0.007	0.004	0.000	0.000	0.000	0.000

**Monthly Discharge**

Cubic Feet	1793	19	0	0	0	154	18754	10487	5	6	5	1
Gallons	13416	143	0	0	0	1150	140288	78449	34	47	40	5
Acre-Feet	0.041	0.000	0.000	0.000	0.000	0.004	0.430	0.241	0.000	0.000	0.000	0.000

**Annual Summaries for WY98**

Partial Data	0.000
Partial Data	0.000
Partial Data	0.000
Partial Data	0.000
Partial Data	0.000

**KEY** WR No data or poor data due to winter icing conditions

BD Bad data due to equipment failures

ITALICS Italic values contain data estimated from field observations and record at adjacent or comparable gages

Table 7-11 Gaging Station GS10 Mean Daily Discharge (Cubic Feet per Second) and Discharge Summaries for Water Year 1998

Day	October-97	November-97	December-97	January-98	February-98	March-98	April-98	May-98	June-98	July-98	August-98	September-98
1	0.086	0.112	0.084	0.129	0.070	0.061	0.313	0.139	0.089	0.056	0.094	0.101
2	0.086	0.088	0.107	0.094	0.072	0.064	0.201	0.131	0.095	0.057	0.070	0.051
3	0.084	0.084	0.122	0.069	0.069	0.064	2.844	0.127	0.095	0.055	0.108	0.049
4	0.089	0.080	0.091	0.067	0.071	0.063	1.044	0.163	0.350	0.056	1.329	0.050
5	0.084	0.076	0.085	0.068	0.071	0.075	0.332	2.098	0.490	0.053	0.116	0.052
6	0.085	0.077	0.083	0.101	0.070	0.071	0.220	0.218	0.120	0.063	0.073	0.044
7	0.084	0.075	0.078	0.097	0.087	0.110	0.236	0.307	0.101	0.057	0.064	0.044
8	0.087	0.085	0.082	0.100	0.066	0.132	0.902	1.100	0.143	0.087	0.060	0.045
9	0.078	0.318	0.086	0.078	0.068	0.108	0.216	0.269	0.120	0.147	0.064	0.045
10	0.082	0.266	0.097	0.074	0.066	0.067	0.172	0.171	0.094	0.069	0.087	0.046
11	0.083	0.181	0.088	0.101	0.084	0.101	0.159	0.159	0.088	0.058	0.070	0.048
12	0.458	0.270	0.092	0.088	0.063	0.087	0.138	0.148	0.085	0.053	0.059	0.105
13	0.093	0.161	0.090	0.106	0.063	0.090	0.135	0.136	0.087	0.052	0.053	0.088
14	0.074	0.220	0.096	0.109	0.063	0.086	0.270	0.127	0.156	0.048	0.052	0.066
15	0.074	0.112	0.099	0.106	0.064	0.083	0.505	0.120	0.134	0.046	0.050	0.062
16	0.075	0.104	0.095	0.087	0.116	0.079	1.340	0.115	0.084	0.047	0.051	0.065
17	0.073	0.118	0.098	0.105	0.074	0.216	0.807	0.109	0.085	0.048	0.049	0.070
18	0.073	0.115	0.092	0.094	0.067	0.411	2.739	0.104	0.075	0.045	0.051	0.077
19	0.074	0.124	0.086	0.091	0.064	0.765	0.699	0.103	0.072	0.045	0.055	0.084
20	0.077	0.123	0.080	0.083	0.063	0.913	0.632	0.102	0.075	0.043	0.058	0.066
21	0.075	0.106	0.075	0.080	0.063	0.869	0.289	0.102	0.076	0.048	0.061	0.095
22	0.073	0.102	0.077	0.076	0.062	0.923	0.243	1.763	0.099	0.328	0.060	0.071
23	0.083	0.095	0.081	0.075	0.061	0.431	0.198	0.457	0.085	0.219	0.063	0.072
24	0.846	0.102	0.079	0.076	0.062	0.228	0.174	0.139	0.070	0.110	0.069	0.064
25	0.246	0.100	0.168	0.075	0.063	0.175	0.158	0.131	0.069	0.805	0.064	0.055
26	1.195	0.090	0.095	0.074	0.058	0.153	2.625	0.127	0.069	0.095	0.067	0.052
27	1.494	0.113	0.082	0.074	0.060	0.157	0.238	0.117	0.064	0.070	0.062	0.053
28	0.695	0.183	0.075	0.073	0.061	0.130	0.177	0.113	0.060	0.069	0.060	0.056
29	0.461	0.088	0.080	0.074	NA	0.125	0.161	0.110	0.058	0.067	0.057	0.059
30	0.417	0.086	0.073	0.072	NA	0.570	0.164	0.106	0.057	0.598	0.058	0.061
31	0.237	NA	0.070	0.072	NA	0.738	NA	0.104	NA	0.095	0.143	NA
Monthly Average	0.247	0.128	0.090	0.086	0.087	0.264	0.611	0.297	0.112	0.119	0.109	0.082

## Monthly Discharge

Cubic Feet	680411	333018	240632	230611	162604	706316	1583857	796343	288817	318430	291987	161879
Gallons	4940217	2491145	1800055	1725090	1216360	5283607	11848072	5957081	2167980	2382024	2184290	1210942
Acre-Feet	15.16	7.64	5.52	5.29	3.73	16.21	36.35	18.28	6.65	7.31	6.70	3.72

## Annual Summaries for WY98

FT/Sec	0.183
GPM	82.20
Cubic Feet	5775914
Gallons	43206843
Acre-Feet	132.58

KEY WR No data or poor data due to winter icing conditions

BD Bad data due to equipment failures

ITALICS Italic values contain data estimated from field observations and record at adjacent or comparable gages

Table 7-10 Gaging Station GS40 Radionuclide Summary Statistics - Water Year 1998

Analyte	Historical					
	Mean (pCi/l)	Max (pCi/l)	N	Std Deviation (pCi/l)	M2SD (pCi/l)	Dates
Americium-241	0.024	0.058	8	0.023	0.070	3/98-9/98
Plutonium-239,240	0.013	0.026	8	0.009	0.031	3/98-9/98
Analyte	Water Year 1998					
	Mean (pCi/l)	Max (pCi/l)	N	# greater than M2SD	Result (pCi/l) / dates of samples greater than M2SD	
Americium-241	0.024	0.058	8	0	N/A	
Plutonium-239,240	0.013	0.026	8	0	N/A	

**Notes**

Water Year 1998 was the first year of operation for GS40, hence the historical and Water Year 1998 statistics are the same

N = number of samples

M2SD = historical mean + 2 standard deviations

**Discussion of Results**

- WY98 was the first year that this station was in operation. No statistically significant (M2SD) variances from the associated historical mean were recorded for radionuclides at this station during WY98.
- The lowest maximum and mean sample results for Pu measured in the IA in WY98 were recorded at GS40 (0.026 pCi/l and 0.013 pCi/l, respectively).

Table 7-9 Gaging Station GS39 Radionuclide Summary Statistics - Water Year 1998

Analyte	Historical					
	Mean (pCi/l)	Max (pCi/l)	N	Std Deviation (pCi/l)	M2SD (pCi/l)	Dates
Americium-241	0.053	0.160	9	0.054	0.161	1/98-9/98
Plutonium-239,240	0.219	0.824	9	0.267	0.752	1/98-9/98
Analyte	Water Year 1998					
	Mean (pCi/l)	Max (pCi/l)	N	# greater than M2SD	Result (pCi/l) / dates of samples greater than M2SD	
Americium-241	0.053	0.160	9	0	N/A	
Plutonium-239,240	0.219	0.824	9	0	N/A	

Notes

Water Year 1998 was the first year of operation for GS39, hence the historical and Water Year 1998 statistics are the same

N = number of samples

M2SD = historical mean + 2 standard deviations

**Discussion of Results**

- WY98 was the first year that this station was in operation. No statistically significant (M2SD) variances from the associated historical mean were recorded for radionuclides at this station during WY98.

Table 7-8 Gaging Station GS37 Radionuclide Summary Statistics - Water Year 1998

Analyte	Historical					
	Mean (pCi/l)	Max (pCi/l)	N	Std Deviation (pCi/l)	M2SD (pCi/l)	Dates
Americium-241	0 013	0 029	16	0 011	0 035	10/97-9/98
Plutonium-239,240	0 055	0 464	16	0 111	0 277	10/97-9/98
Tritium	161	320	16	106	373	10/97-9/98
Total Uranium	0 728	1 965	16	0 580	1 888	10/97-9/98
Analyte	Water Year 1998					
	Mean (pCi/l)	Max (pCi/l)	N	# greater than M2SD	Result (pCi/l) / dates of samples greater than M2SD	
Americium-241	0 013	0 029	16	0	N/A	
Plutonium-239,240	0 055	0 464	16	1	0 464, 5/8/98	
Tritium	161	320	16	0	N/A	
Total Uranium	0 728	1 965	16	2	1 963, 4/2/98 and 1 965, 3/17/98	

**Notes**

Water Year 1998 was the first year of operation for GS37, hence the historical and Water Year 1998 statistics are the same

N = number of samples

M2SD = historical mean + 2 standard deviations

**Discussion of Results**

- Notable GS37 sample results statistically significant (M2SD) variance from the associated historical mean was recorded for one sample (0 464 pCi/l Pu on 5/8/98). A statistically significant (M2SD) result for Pu was not detected during the severe storm event of 5/22/98 for the corresponding downstream IA perimeter station (SW022).
- The lowest maximum and mean sample results for Am measured in the IA in WY98 were recorded at GS37 (0 029 pCi/l and 0 013 pCi/l, respectively). In addition, the station with the lowest mean for U samples was station GS37 (1 965 pCi/l).

## **Discussion of Results**

- WY98 was the second year of operation for this station. As was the case in WY97, the mean values for Am and Pu were greater than those of the downstream IA perimeter station (SW093). The mean U activity for GS32, in contrast, was less than that at SW093.
- Notable GS32 sample results statistically significant (M2SD) variances from the associated historical mean were recorded for three radionuclides during the same storm (3 260 pCi/l Am on 5/22/98, 6 970 pCi/l Pu on 5/22/98, and 2 788 total U pCi/l on 5/22/98). All of these results came from samples collected during the severe storm that deposited approximately 0.25 inches of rain within a fifteen minute period (as measured at rain gauges located at SW118 and SW022). Samples with statistically elevated results were not collected at the downstream IA perimeter station (SW093) during the same storm.

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Table 7-6 Gaging Station GS27 Radionuclide Summary Statistics - Water Year 1998

Analyte	Historical (3 Years)					
	Mean (pCi/l)	Max (pCi/l)	N	Std Deviation (pCi/l)	M2SD (pCi/l)	Dates
Americium-241	4 344	20 1	26	6 012	16 369	10/95-9/98
Plutonium-239,240	14 963	75 6	26	21 282	57 528	10/95-9/98
Total Uranium	0 834	3 557	25	0 803	2 439	10/95-9/98
Analyte	Water Year 1998					
	Mean (pCi/l)	Max (pCi/l)	N	# greater than M2SD	Result (pCi/l) / dates of samples greater than M2SD	
Americium-241	3 426	14 8	12	0	N/A	
Plutonium-239,240	12 403	64 3	12	1	64 3, 5/22/98	
Total Uranium	0 601	2 123	12	0	N/A	

**Notes**

N = number of samples

M2SD = historical mean + 2 standard deviations

**Discussion of Results**

- The maximum Pu activity in a single surface-water sample measured in the IA during WY98 was 64 3 pCi/l measured at station GS27 (5/22/98). This statistically significant (M2SD) result was collected during the severe storm noted for station GS32 that deposited approximately 0.25 inches of rain within a fifteen minute period. For comparison, in WY96 and WY97 the maximum Pu activities measured in the IA in single samples were also at GS27 (75 6 pCi/l on 6/22/96 and 6 190 pCi/l on 8/4/97).
- The highest mean Pu activity at a single monitoring station during WY98 was 12 403 pCi/l for samples collected at station GS27. This compares to the historic mean for GS27 of 14 963 pCi/l Pu dating back to October 1995. It should be noted that several changes in the GS27 drainage basin occurred at the end of FY96. These included the D&D of Building 889, the removal of sediments with approximately 5 pCi/g of plutonium-239,240, and the application of a soil sealant to the majority of the drainage basin.
- The maximum Am activity in a single surface water sample measured in the IA during WY98 was 14 8 pCi/l measured at station GS27. Again, this sample was collected during the severe storm event of 5/22/98 noted previously.

Table 7-5 Gaging Station SW093 Radionuclide Summary Statistics - Water Year 1998

Analyte	Historical (3 Years)					
	Mean (pCi/l)	Max (pCi/l)	N	Std Deviation (pCi/l)	M2SD (pCi/l)	Dates
Americium-241	0 028	0 628	73	0 078	0 184	10/95-9/98
Plutonium-239,240	0 047	1 33	73	0 159	0 366	10/95-9/98
Total Uranium	3 205	6 64	73	1 551	6 307	10/95-9/98
Analyte	Water Year 1998					
	Mean (pCi/l)	Max (pCi/l)	N	# greater than M2SD	Result (pCi/l) / dates of samples greater than M2SD	
Americium-241	0 015	0 071	37	0	N/A	
Plutonium-239,240	0 015	0 079	37	0	N/A	
Total Uranium	2 759	5 851	37	0	N/A	

Notes

N = number of samples

M2SD = historical mean + 2 standard deviations

Discussion of Results

- No samples were collected during WY98 at SW093 with a statistically significant (M2SD) variance from the associated historical mean for Pu, Am or U

Table 7-4 Gaging Station SW091 Radionuclide Summary Statistics - Water Year 1998

Analyte	Historical (3 Year)					
	Mean (pCi/l)	Max (pCi/l)	N	Std Deviation (pCi/l)	M2SD (pCi/l)	Dates
Americium-241	0 153	0 686	12	0 189	0 531	10/95-9/98
Plutonium-239,240	0 214	0 958	12	0 298	0 810	10/95-9/98
Total Uranium	4 762	7 496	12	1 663	8 088	10/95-9/98
Analyte	Water Year 1998					
	Mean (pCi/l)	Max (pCi/l)	N	# greater than M2SD	Result (pCi/l) / dates of samples greater than M2SD	
Americium-241	0 086	0 247	6	0	N/A	
Plutonium-239,240	0 080	0 145	6	0	N/A	
Total Uranium	4 567	6 917	6	0	N/A	

Notes

N = number of samples

M2SD = historical mean + 2 standard deviations

Discussion of Results

- The highest mean total uranium activity measured in the IA in WY98 was 4 567 pCi/l for samples collected at station SW091. This compares to the historic mean (dating back three years) for total uranium at SW091 of 4 762 pCi/l.

Table 7-3 Gaging Station SW027 Radionuclide Summary Statistics - Water Year 1998

Analyte	Historical (3 Year)					
	Mean (pCi/l)	Max (pCi/l)	N	Std Deviation (pCi/l)	M2SD (pCi/l)	Dates
Americium-241	0.021	0.124	24	0.031	0.084	10/95-9/98
Plutonium-239,240	0.091	0.802	25	0.165	0.421	10/95-9/98
Total Uranium	2.388	5.7	25	1.454	5.296	10/95-9/98
Analyte	Water Year 1998					
	Mean (pCi/l)	Max (pCi/l)	N	# greater than M2SD	Result (pCi/l) / dates of samples greater than M2SD	
Americium-241	0.036	0.124	7	2	0.124, 4/30/98 and 0.106, 5/8/98	
Plutonium-239,240	0.230	0.802	7	1	0.802, 4/30/98	
Total Uranium	3.329	4.576	7	0	N/A	

**Notes**

N = number of samples

M2SD = historical mean + 2 standard deviations

**Discussion of Results**

- Notable SW027 sample results statistically significant (M2SD) variances from the associated historical mean for Am were measured on two dates (0.124 pCi/l on 4/30/98, 0.106 on 5/8/98) and for Pu on one date (0.124 pCi/l on 4/30/98)
- WY98 arithmetic means for Am, Pu, and U activities were all the same order of magnitude but higher than their respective means for WY97. Watershed improvements, including revegetation and soil sealant application, occurred in this basin in both WY96 and WY97.

Table 7-2 Gaging Station SW022 Radionuclide Summary Statistics - Water Year 1998

Analyte	Historical (3 Year)					
	Mean (pCi/l)	Max (pCi/l)	N	Std Deviation (pCi/l)	M2SD (pCi/l)	Dates
Amencium-241	0 141	1 76	34	0 32	0 78	10/95-9/98
Plutonium-239,240	0 732	9 49	34	1 886	4 504	10/95-9/98
Total Uranium	1 468	3 913	32	1 091	3 651	10/95-9/98
Analyte	Water Year 1998					
	Mean (pCi/l)	Max (pCi/l)	N	# greater than M2SD	Result (pCi/l) / dates of samples greater than M2SD	
Amencium-241	0 29	1 76	9	1	1 76, 5/22/98	
Plutonium-239,240	1 467	9 49	9	1	9 49, 5/22/98	
Total Uranium	1 604	3 143	9	0	N/A	

Notes

N = number of samples

M2SD = historical mean + 2 standard deviations

Discussion of Results

- Notable SW022 sample results statistically significant (M2SD) variances from the associated historical means were recorded for two radionuclides during the severe storm of 5/22/98 (1 76 pCi/l Am and 9 49 pCi/l Pu) These samples were collected during this storm which deposited approximately 0 25 inches of rain within a fifteen minute period

Table 7-1 Gaging Station GS10 Radionuclide Summary Statistics - Water Year 1998

Analyte	Historical (3 Years)					
	Mean (pCi/l)	Max (pCi/l)	N	Std Deviation (pCi/l)	M2SD (pCi/l)	Dates
Americium-241	0.142	2.21	78	0.278	0.699	10/95-9/98
Plutonium-239,240	0.159	1.91	78	0.290	0.738	10/95-9/98
Total Uranium	2.85	5.75	78	1.08	5.01	10/95-9/98
Analyte	Water Year 1998					
	Mean (pCi/l)	Max (pCi/l)	N	# greater than M2SD	Result (pCi/l) / dates of samples greater than M2SD	
Americium-241	0.086	0.728	34	1	0.728, 7/23/98	
Plutonium-239,240	0.103	0.761	34	1	0.761, 5/12/98	
Total Uranium	2.98	5.203	34	1	5.203, 3/23/98	

Notes

N = number of samples

M2SD = historical mean + 2 standard deviations

Discussion of Results

- Notable GS10 sample results statistically significant (M2SD) variances from the associated historical means were recorded for three radionuclides (0.728 pCi/l Am on 7/23/98, 0.761 pCi/l Pu on 5/12/98 and 5.203 pCi/l U on 3/23/98). Further characterization of water quality in the sub-basins upstream from GS10 was ongoing at the time these samples were collected. As part of the RFCA Source Evaluation for Walnut Creek, additional monitoring at two new stations (i.e., GS39 and GS40) was performed to better define radionuclide source areas in the GS10 drainage basin.

## **7. APPENDIX B**

### **7.1 INDUSTRIAL AREA SURFACE WATER MONITORING - WATER YEAR 1998 SUMMARY**

This section of the Quarterly Environmental Monitoring Report is included to present Industrial Area surface water monitoring data that was formerly presented in the Industrial Area Interim Measures/Interim Remedial Action (IA IM/IRA) Annual Report. Because the IA IM/IRA predated the Rocky Flats Cleanup Agreement (RFCA) and the Integrated Monitoring Plan (IMP), a significant degree of redundancy in environmental data reporting had developed. To correct this situation, the RFCA Coordinators formally agreed on February 22, 1999, to eliminate the IA IM/IRA Annual Report with the understanding that the data from that report be presented in other, existing reporting forums. The data in this section is included to satisfy those reporting requirements for surface water.

Groundwater data formerly included in the IA IM/IRA Annual Report are now presented in the RFCA quarterly and annual groundwater reports. Air data formerly included in the IA IM/IRA Annual Report are now presented in this Quarterly Environmental Monitoring Report and in the RAD Air Emissions Annual Report.

The Industrial Area IM/IRA Annual Report was previously published each March for data collected during the prior Water Year (October through September). Because the determination of the RFCA Coordinators to eliminate the IA IM/IRA Annual Report occurred in February, the next feasible time to publish that data in a Quarterly Environmental Monitoring Report was in August (this report). Hence, surface water data presented in this section are for Industrial Area monitoring stations that were operational during Water Year 1998 (October 1997 through September 1998) and duplicates some data already presented in respective Quarterly Environmental Monitoring reports. Future similar annual compilations of Industrial Area surface water data will be in the Quarterly Environmental Monitoring Report that is expected to be published in February.

Data are presented for the following Industrial Area surface water monitoring stations:

RFCA IMP New Source Detection stations (located on the perimeter of the Industrial Area)

GS10, SW022, SW027, SW091, and SW093

RFCA IMP Performance Monitoring stations (located in the interior of the Industrial Area)

GS27, GS32, GS37, GS39, and GS40

The radiation dose received by the MEI individual is 0.37 mrem. This radiation dose is well within the radiation dose limit of 100 mrem in DOE Order 5400.5. The following table gives the breakdown of radiation dose by radionuclide and by exposure pathway for the MEI individual.

Table 6-1 Radiation Dose by Radionuclide and Exposure Pathway for MEI

Radionuclide	Soil Inhalation Radiation Dose (mrem)	Soil Ingestion Radiation Dose (mrem)	External Irradiation Radiation Dose (mrem)	Water Ingestion Radiation Dose (mrem)	Total Radiation Dose By Radionuclide (mrem)
Am-241	2.15E-02	5.84E-02	5.54E-03	3.28E-04	8.58E-02
Pu-239/240	5.56E-03	2.70E-01	1.29E-04	2.48E-04	2.76E-01
U-234	2.12E-04	2.87E-08	3.07E-10	1.73E-03	1.94E-03
U-235	1.09E-04	1.49E-08	1.60E-07	6.65E-05	1.76E-04
U-238	1.79E-04	2.43E-08	1.27E-10	1.84E-03	2.02E-03
H-3	1.40E-10	0.00E+00	0.00E+00	5.60E-05	5.60E-05
TOTAL	2.8E-02	3.3E-01	5.7E-03	4.3E-03	3.7E-01

### Collective Dose

DOE Order 5400.5 requires the assessment of collective population radiation dose to a distance of 80-km (50 miles). Collective population dose is calculated as the average radiation dose to an individual in a specified area, multiplied by the number of individuals in that area. In assessing the 1998 collective population dose to the public from RFETS, the assessment was limited to airborne emissions of radioactive materials from the Site as the major contributor to population dose.

The collective dose assessment was performed in the 1998 Radionuclide Air Emissions Annual Report using the computer model CAP88-PC. The population surrounding RFETS was based on 1994 data adjusted for regional growth. The collective dose was calculated to be 6.48 person-rem for CY 1998.



public Surface soil concentrations of radioactive material will be used to quantify the amount of radioactive material ingested in soil by a member of the public as well as to quantify external radiation exposure to a member of the public

### Location of Members of the Public Surrounding RFETS

In order to compare the radiation dose to a member of the public with radiation dose limits, it is necessary to identify the MEI (Maximally Exposed Individual) member of the public This member of the public will receive the highest radiation dose from radioactive material released from RFETS The radiation dose received by the MEI member of the public will be used to compare with public radiation dose limits

To identify the MEI member of the public, eight locations surrounding RFETS were investigated The nearest member of the public was assessed in the north, northwest, southwest, south and east (4 locations) directions from RFETS All of these locations are private residents

### Exposure Pathway Analysis

The most significant exposure pathways for a resident will be assessed in this radiation dose assessment The exposure pathways of 1) Inhalation of radioactive material in air, 2) Ingestion of radioactive material in surface soil, 3) External exposure from radioactive material in surface soil, and 4) Ingestion of surface water will be assessed in this radiation dose assessment The ingestion of homegrown produce was not assessed due to the high dilution of radioactive material deposited on surface soil during tilling

All of these exposure pathways may not be applicable to each of the eight locations being examined and/or may not be significant to each of these eight locations at the boundary of RFETS This is because surface water is preferentially released to the east of RFETS and because the surface soils east of RFETS contain elevated concentrations of radioactive material Therefore, the ingestion of radioactive material in surface water will only be applicable to those locations east of RFETS Also, the ingestion of radioactive material in surface soil as well as the external exposure from radioactive material in surface soil will be most significant east of RFETS

For the inhalation of radioactive material in air, ingestion of radioactive material in surface soil and external exposure from radioactive material in surface soil exposure pathways, the EPA's Reasonable Maximum Exposure (RME) exposure parameters for a resident will be used Exposure parameters were taken from EPA's OSWER Directive 9285 6-03, "Human Health Evaluation Manual, Supplemental Guidance 'Standard Default Exposure Factors' " The RME exposure parameters represent the maximum exposure reasonably expected by an individual

For the ingestion of surface water exposure pathway, it is not reasonable to assume that a resident would use the surface water released from RFETS for household use Surface water from RFETS is released intermittently in both Walnut Creek and Woman Creek and is not a reliable water supply In Walnut Creek, surface water is released to a waterway that is not used as a drinking water supply Surface water

## 6. APPENDIX A

### 6.1 1998 PUBLIC RADIATION DOSE ASSESSMENT FOR THE ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

#### Introduction

A public radiation dose assessment was performed for calendar year (CY) 1998 to support the requirements of DOE Order 5400.5, "Radiation Protection of the Public and the Environment." This DOE Order states that the radiation dose to the public will be assessed from exposures to radiation sources from routine activities at a DOE facility and from property released subsequent to remedial action at that facility. This public radiation dose will be compared with the annual radiation dose limit of 100 mrem from this Order to assure that the radiation dose limit is not exceeded. The member of the public that received the highest radiation dose from radiation sources at the Rocky Flats Environmental Technology Site (RFETS) is called the Maximally Exposed Individual (MEI). The radiation dose received by the MEI will be compared with the annual radiation dose limit of 100 mrem. For CY 1998, the MEI was located at Mower Lake. The radiation dose received by this MEI was 0.37 mrem. This radiation dose is well within the annual radiation dose limit of 100 mrem.

#### Radiation Protection Standards For The Public

Standards for protection of the public from radiation sources are based on the concept of radiation dose. This concept provides a means for quantifying the biological effect or risk from all types of radiation on a common basis. Radiation dose is expressed in rem or mrem (1 rem = 1,000 mrem). Radiation protection standards are based on guidance from the National Council on Radiation Protection and Measurement (NCRP) and the International Commission on Radiological Protection (ICRP). These organizations are internationally recognized for their expertise in radiation protection principles. DOE Order 5400.5 prescribes an annual public radiation dose limit of 100 mrem that is based on guidance from the NCRP and ICRP.

#### Radiation Dose Assessment Methodology

In order to assess the radiation dose to a member of the public from radiation sources at RFETS, a number of steps need to be followed. These steps are identified as:

1. The radiation sources at RFETS that release radioactive material to the environment need to be analyzed, and the releases from these sources need to be quantified,
2. The members of the public closest to the boundary of RFETS need to be located,

The incidental waters requiring treatment were dispositioned to the following Site treatment facilities discussed previously

- Building 995 - WWTP 4
- Building 891 - CWTF 17
- Building 374 3

## 5. INCIDENTAL WATERS

### 5.1 INCIDENTAL WATERS DEFINITION AND ROUTING MATRIX

An incidental water is defined as precipitation, surface water, groundwater, utility water, process water, or waste water collecting in one or more of several types of containments. These containments can include excavation sites, foundation drains, secondary containment berms, electrical vaults, utility pits and manholes, or other natural or manmade depressions, which must be dewatered.

Water collected in this manner has the potential to become contaminated via contact with the surrounding containment material. Sampling and disposition of incidental waters is conducted per Site Procedure 1-C91-EPR-SW 01, *Control and Disposition of Incidental Waters*. Incidental waters are typically sampled for pH, nitrates, conductivity, and gross alpha and gross beta (when radionuclides are suspected). Additional testing for volatile organic compounds and metals is performed when a specific potential contaminant source is known to exist. Disposition depends on the analytical results. Routing options for incidental waters are outlined in the following table.

Table 5-1 Incidental Waters Routing Matrix

Incidental Water Routing	Routing Criteria	Treatment Processes
Ground/Storm Drain	<ul style="list-style-type: none"> <li>Water meets discharge limits per Incidental Waters procedure</li> </ul>	N/A
Building 995 Waste Water Treatment Plant (WWTP)	<ul style="list-style-type: none"> <li>Water above discharge to ground limits</li> <li>Water meets Internal Waste Streams Program review criteria</li> </ul>	Activated Sludge w/ tertiary clarifiers Dual media filtration UV disinfection
Building 891 Consolidated Water Treatment Facility (CWTF)	<ul style="list-style-type: none"> <li>Water above discharge to ground limits</li> <li>Water not accepted by WWTP</li> <li>Water meets CWTF acceptance criteria and has both radionuclide and organic constituents</li> </ul>	Chemical precipitation Microfiltration UV/ peroxide oxidation Granular activated carbon Ion exchange
Building 374	<ul style="list-style-type: none"> <li>Water above discharge to ground limits</li> <li>Water not accepted by WWTP</li> <li>Water has radionuclides, but no organic constituents</li> </ul>	Flash evaporation (Steam-heated reactor with spray evaporation)

Table 4-16 Other Metals Water Year 1999 (April, May, and June), continued

Analyte ug/l	Result SW022, 4/29/99	Result SW022, 5/20/99	Result SW022, 6/14/99	Result SW022, 6/15/99
Aluminum	4280	47300	1850	3380
Antimony	12 2	3 2	10 6	15 3
Arsenic	2 3	15 2	1 8	3
Barium	78 7	295	51	60 2
Beryllium	0 18	2 9	0 09	0 19
Cadmium	0 26	0 43	0 19	0 14
Calcium	34800	20200	20200	23500
Chromium	5 9	44 3	3 2	4 9
Cobalt	1	12	0 98	0 91
Copper	8 6	35 6	8 2	8 6
Iron	3530	40200	1710	2730
Lead	3 5	31 1	2 6	2 7
Lithium	7	36 6	3 4	4 8
Magnesium	6970	9370	3820	3810
Manganese	46 7	844	37 1	39 2
Mercury	undetect	undetect	undetect	undetect
Molybdenum	1 5	1 8	0 74	2
Nickel	3 9	33 9	2 7	3 5
Potassium	3460	9570	4420	2930
Selenium	1 8	undetect	undetect	undetect
Silver	undetect	undetect	undetect	undetect
Sodium	32400	9640	12900	14800
Strontium	219	128	120	128
Thallium	undetect	1 1	undetect	2 2
Tin	undetect	1 5	undetect	undetect
Vanadium	9 7	86 9	6	7 9
Zinc	91 1	168	59 9	61 3

Table 4-15 POE Metals, Water Year 1999 (April, May, and June), continued

Location	Sample Dates	Analyte Be ug/L	Analyte Dissolved Cd ug/L	Analyte Cr ug/L	Analyte Dissolved Ag ug/L
SW093	6/16 - 6/24/99	0.04	0.09	0.75	1.9
SW093	6/24 - 7/2/99	undetected	undetected	0.43	undetected

Table 4-14 Radionuclides, Water Year 1999 (April, May, and June), continued

Location	Sample Dates	Analyte Pu-239, -240 [pCi/l]	Analyte Am-241 [pCi/l]	Analyte Total Uranium [pCi/l]	Analyte Tritium [pCi/l]
SW091	4/25/99	0 020	0 033	3 898	a
SW091	4/28/99	0 014	0 028	5 878	a
SW091	4/29/99	0 025	0 048	3 669	a
SW093	3/16 - 3/30/99	0 003	-0 005	4 164	a
SW093	3/30 - 4/15/99	0 021	0 017	2 158	a
SW093	4/15 - 4/19/99	0 029	0 001	1 086	a
SW093	4/19 - 4/23/99	0 055	0 016	1 033	a
SW093	4/23 - 4/26/99	0 005	-0 004	1 229	a
SW093	4/26 - 4/29/99	0 037	0 029	1 262	a
SW093	4/29 - 5/1/99	-0 003	-0 001	0 823	a
SW093	5/1 - 5/4/99	0 007	0 050	1 424	a
SW093	5/4 - 5/17/99	-0 006	0 009	2 764	a
SW093	5/17 - 5/24/99	0 034	0 041	1 749	a
SW093	5/24 - 6/8/99	0 015	0 002	3 098	a
SW093	6/8 - 6/14/99	0 000	0 022	2 259	a
SW093	6/14 - 6/16/99	0 051	0 049	1 338	a
SW093	6/16 - 6/24/99	0 022	-0 003	3 303	a
SW093	6/24 - 7/2/99	-0 003	0 002	4 901	a

a Not applicable

Table 4-14 Radionuclides, Water Year 1999 (April, May, and June), continued

Location	Sample Dates	Analyte Pu-239, -240 [pCi/l]	Analyte Am-241 [pCi/l]	Analyte Total Uranium [pCi/l]	Analyte Tritium [pCi/l]
GS08	3/25 - 3/29/99	0 015	-0 003	1 311	a
GS08	3/29 - 4/5/99	0 005	0 013	1 559	a
GS08	4/26 - 4/29/99	0 010	0 002	1 880	a
GS08	4/29 - 5/2/99	0 040	0 014	1 574	a
GS08	5/2 - 5/6/99	0 004	0 013	1 588	a
GS08	5/6 - 5/11/99	0 011	0 015	1 930	a
GS08	5/11 - 5/18/99	0 004	0 009	2 062	a
GS08	6/18 - 6/23/99	0 009	0 002	1 653	a
GS08	6/23 - 6/30/99	0 603	0 154	1 324	a
GS10	3/15 - 3/30/99	0 005	0 105	4 102	a
GS10	3/30 - 4/15/99	0 315	1 930	2 222	a
GS10	4/15 - 4/22/99	0 201	0 362	2 190	a
GS10	4/22 - 4/24/99	0 046	0 109	2 108	a
GS10	4/24 - 4/29/99	0 177	0 594	2 514	a
GS10	4/29 - 5/1/99	0 130	0 062	1 645	a
GS10	5/1 - 5/10/99	0 021	0 076	4 256	a
GS10	5/10 - 5/24/99	0 543	0 768	3 581	a
GS10	5/24 - 6/10/99	0 073	0 157	4 475	a
GS10	6/10 - 6/14/99	0 189	0 284	2 203	a
GS10	6/14 - 6/17/99	0 152	0 116	1 614	a
GS10	6/17 - 6/29/99	0 047	0 163	4 962	a
GS10	6/29 - 7/8/99	b	b	b	a
GS11	5/3 - 5/5/99	0 004	-0 002	2 048	a
GS11	5/5 - 5/7/99	0 035	0 006	1 717	a
GS11	5/7 - 5/9/99	0 005	-0 003	2 121	a
GS11	5/9 - 5/12/99	0 014	0 016	1 854	a
GS11	5/12 - 5/18/99	0 012	0 000	1 940	a
GS27	4/2/99	0 731	0 173	c	a
GS27	4/13/99	1 640	0 458	0 252	a
GS27	4/28/99	0 875	0 303	0 102	a
GS27	4/29/99	2 590	0 766	0 370	a
GS27	5/1/99	5 890	1 430	0 357	a
GS27	5/20/99	26 800	7 280	1 145	a
GS27	5/22/99	1 990	0 517	0 359	a
GS27	6/10/99	3 140	0 756	0 760	a
GS31	6/3 - 6/5/99	0 017	-0 004	2 432	a

- a Not applicable  
b Incomplete laboratory analysis  
c Not collected



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Gaging Station SW022 is located 39° 53' 30"N, 105° 11' 30"W, at the Central Avenue Ditch at the Inner East Gate (See Section 4 Map) This location is a RFCA New Source Detection Location and monitors water in the Central Avenue Ditch entering the B-Series Ponds and South Walnut Creek Storm event samples are collected for selected radionuclides

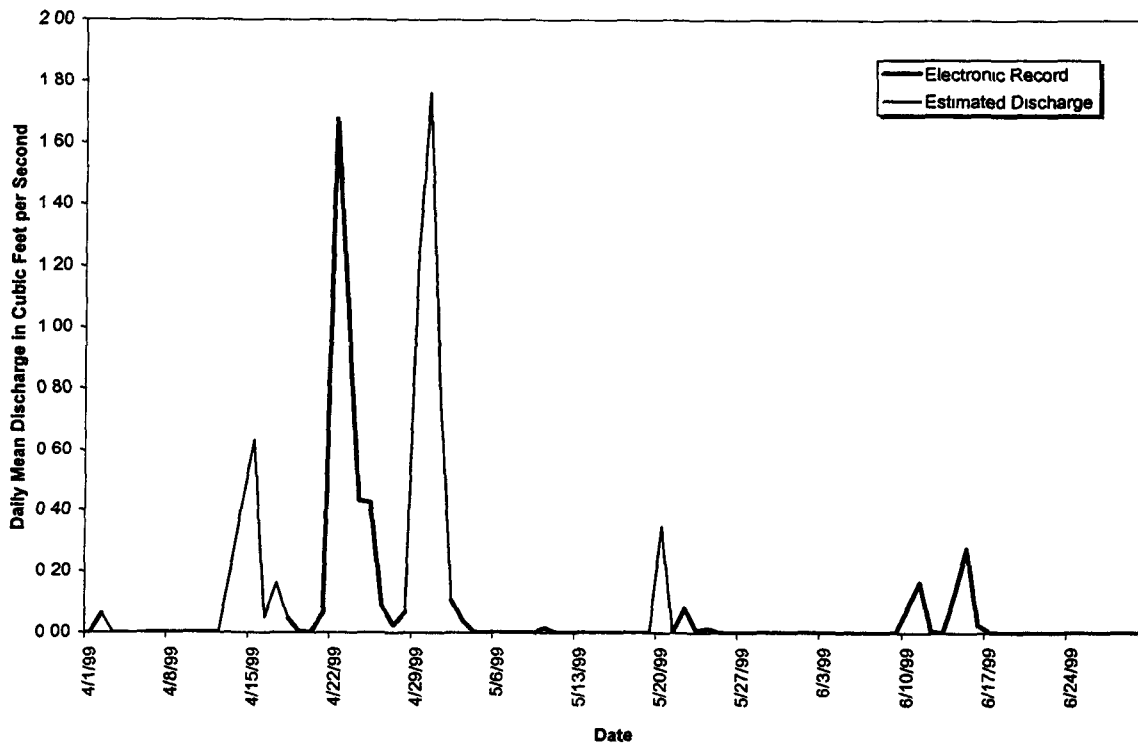


Figure 4-10 Mean Daily Discharge at SW022, Water Year 1999 (April, May, and June)

Gaging Station SW027 is located 39° 53' 12" N, 105° 11' 4" W, at the South Interceptor Ditch above Pond C-2 (See Section 4 Map) This station is in the RFA Action Level Framework and a New Source Detection Location and monitors water in the South Interceptor Ditch entering Pond C-2 This station collects samples for selected radionuclides, metals, and water quality parameters using continuous flow-paced sampling

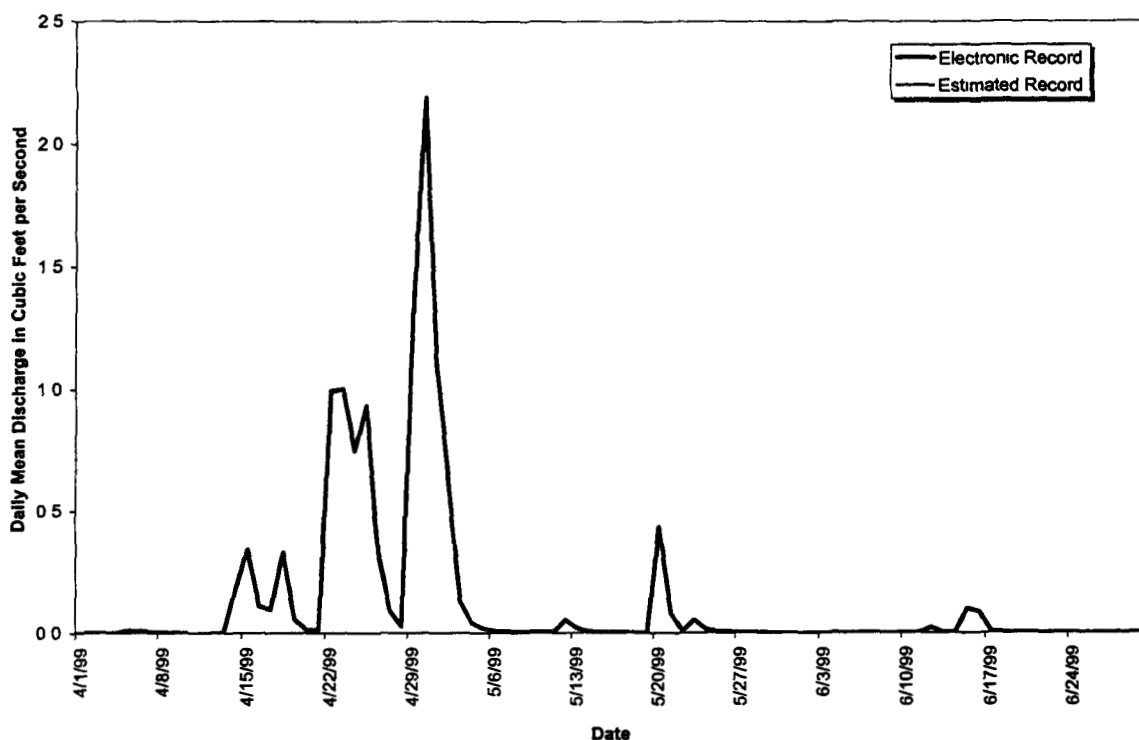


Figure 4-11 Mean Daily Discharge at SW027, Water Year 1999 (April, May, and June)

Table 4-13 Gaging Station SW093 Mean Daily Discharge (cubic feet per second)

Day	April-99	May-99	June-99
1	0 071	3 411a	0 141
2	0 281	1 237	0 135
3	0 190	0 728	0 126
4	0 178	0 521	0 118
5	0 185	0 386	0 113
6	0 112	0 334	0 094
7	0 088	0 304	0 095
8	0 061	0 263	0 085
9	0 069	0 229	0 221
10	0 052	0 318	0 281
11	0 080	0 223	0 352
12	0 075	0 185	0 179
13	0 343	0 174	0 118
14	1 184	0 155	0 334
15	1 391	0 142	0 718
16	0 523	0 188	0 355
17	0 918	0 157	0 214
18	0 764	0 139	0 137
19	0 403	0 133	0 113
20	0 235	1 721a	0 104
21	0 333	0 326	0 099
22	4 109	0 349	0 094
23	2 872	0 346	0 090
24	2 351	0 310	0 084
25	2 573	0 283	0 081
26	1 100	0 198	0 077
27	0 587	0 166	0 080
28	0 622	0 153	0 077
29	4 423a	0 186	0 070
30	6 092	0 146	0 069
31	NA	0 142	NA
Monthly Average (cfs)	1 076	0 437	0 162

Monthly Discharge

Cubic Feet	2787777	1170864	419214
Gallons	20854020	8758674	3135941
Acre-Feet	63 99	26 88	9 62

Note Mean flow values are reported to the nearest 0 001 cfs, values less than 0 0005 cfs are reported as zero

<sup>a</sup> Contains data estimated from field observations and electronic record at adjacent or comparable gages

Table 4-10 Gaging Station SW022 Mean Daily Discharge (cubic feet per second)

Day	April-99	May-99	June-99
1	0 000	0 756a	0 000
2	0 062	0 105	0 000
3	0 001a	0 038	0 000
4	0 001	0 002	0 000
5	0 000a	0 000	0 000
6	0 000	0 000	0 000
7	0 000	0 000	0 000
8	0 000	0 000	0 000
9	0 000	0 000	0 000
10	0 000	0 014	0 078
11	0 000	0 000	0 162
12	0 000	0 000	0 005
13	0 197a	0 000	0 000
14	0 423a	0 000	0 124
15	0 632	0 000	0 275
16	0 049a	0 000	0 024
17	0 161a	0 000	0 001
18	0 046	0 000	0 000
19	0 001	0 000	0 000
20	0 000	0 346a	0 000
21	0 065	0 000	0 000
22	1 678	0 079	0 000
23	1 068	0 007	0 000
24	0 430	0 013	0 000
25	0 424	0 000	0 000
26	0 086	0 000	0 000
27	0 023	0 000	0 000
28	0 067	0 000	0 000
29	1 206a	0 000	0 000
30	1 762	0 000	0 000
31	NA	0 000	NA
Monthly Average (cfs)	0 279	0 044	0 022

Monthly Discharge

Cubic Feet	724199	117711	57888
Gallons	5417382	880537	433034
Acre-Feet	16 62	2 70	1 33

Note Mean flow values are reported to the nearest 0 001 cfs, values less than 0 0005 cfs are reported as zero

\* Contains data estimated from field observations and electronic record at adjacent or comparable gages

Table 4-9 Gaging Station GS40 Mean Daily Discharge (cubic feet per second)

Day	April-99	May-99	June-99
1	0 034	0 423	0 045
2	0 160	0 131	0 049
3	0 072	0 085	0 051
4	0 106	0 069	0 049
5	0 079	0 060	0 040
6	0 039	0 063	0 038
7	0 038	0 072	0 039
8	0 035	0 060	0 042
9	0 034	0 048	0 127
10	0 031	0 097	0 111
11	0 032	0 048	0 154
12	0 032	0 041	0 043
13	0 189	0 035	0 044
14	0 272	0 034	0 149
15	0 306	0 034	0 219
16	0 106	0 079	0 081
17	0 157	0 036	0 048
18	0 181	0 035	0 047
19	0 060	0 036	0 047
20	0 046	0 241	0 049
21	0 128	0 043	0 049
22	0 703	0 123	0 048
23	0 527	0 058	0 047
24	0 331	0 083	0 037
25	0 446	0 059	0 035
26	0 215	0 056	0 033
27	0 114	0 063	0 034
28	0 181	0 043	0 034
29	0 620	0 063	0 035
30	0 789	0 044	0 037
31	NA	0 045	NA
Monthly Average (cfs)	0 202	0 078	0 062

Monthly Discharge

Cubic Feet	523815	207884	160604
Gallons	3918409	1555080	1201404
Acre-Feet	12 02	4 77	3 69

Note Mean flow values are reported to the nearest 0 001 cfs, values less than 0 0005 cfs are reported as zero

Table 4-8 Gaging Station GS39 Mean Daily Discharge (cubic feet per second)

Day	April-99	May-99	June-99
1	0 0000	0 0712	0 0000
2	0 0136	0 0044	0 0000
3	0 0044a	0 0000	0 0000
4	0 0018a	0 0000	0 0000
5	0 0032	0 0000	0 0000
6	0 0000	0 0000	0 0000
7	0 0000	0 0000	0 0000
8	0 0000	0 0000	0 0000
9	0 0000	0 0000	0 0051
10	0 0000	0 0025	0 0099
11	0 0000	0 0000	0 0280
12	0 0000	0 0000	0 0009
13	0 0216	0 0000	0 0000
14	0 0442	0 0000	0 0213
15	0 0622	0 0000	0 0314
16	0 0080a	0 0024	0 0042
17	0 0150a	0 0002	0 0002
18	0 0057a	0 0000	0 0000
19	0 0000	0 0000	0 0000
20	0 0000	0 0305	0 0000
21	0 0098a	0 0000	0 0000
22	0 1690a	0 0125	0 0000
23	0 1082a	0 0018	0 0000
24	0 0340a	0 0055	0 0000
25	0 0318a	0 0003	0 0000
26	Bad data/equipment fail	0 0000	0 0000
27	Bad data/equipment fail	0 0000	0 0000
28	0 0135	0 0000	0 0000
29	0 1330	0 0007	0 0000
30	0 1668	0 0000	0 0000
31	NA	0 0000	NA
Monthly Average (cfs)	0 030	0 004	0 003

Partial Data

Monthly Discharge

Cubic Feet	73075	11405	8727
Gallons	546637	85313	65279
Acre-Feet	1 68	0 26	0 20

Note Mean flow values are reported to the nearest 0 001 cfs, values less than 0 0005 cfs are reported as zero

<sup>a</sup> Contains data estimated from field observations and electronic record at adjacent or comparable gages

Table 4-7 Gaging Station GS31 Mean Daily Discharge (cubic feet per second)

Day	April-99	May-99	June-99
1	0 000	0 000	0 000
2	0 000	0 000	0 000
3	0 000	0 000	1 135
4	0 000	0 000	1 909
5	0 000	0 000	1 938
6	0 000	0 000	1 743
7	0 000	0 000	2 122
8	0 000	0 000	2 471
9	0 000	0 000	2 220
10	0 000	0 000	0 849
11	0 000	0 000	0 000
12	0 000	0 000	0 000
13	0 000	0 000	0 000
14	0 000	0 000	0 805
15	0 000	0 000	0 621a
16	0 000	0 000	0 595a
17	0 000	0 000	0 378
18	0 000	0 000	0 543
19	0 000	0 000	0 860
20	0 000	0 000	0 077
21	0 000	0 000	0 035
22	0 000	0 000	0 000
23	0 000	0 000	0 000
24	0 000	0 000	0 000
25	0 000	0 000	0 000
26	0 000	0 000	0 000
27	0 000	0 000	0 000
28	0 000	0 000	0 000
29	0 000	0 000	0 000
30	0 000	0 000	0 000
31	NA	0 000	NA
Monthly Average (cfs)	0 000	0 000	0 610

Monthly Discharge

Cubic Feet	0	0	1581198
Gallons	0	0	11828181
Acre-Feet	0 00	0 00	36 29

Note Mean flow values are reported to the nearest 0 001 cfs, values less than 0 0005 cfs are reported as zero

<sup>a</sup> Contains data estimated from field observations and electronic record at adjacent or comparable gages



Table 4-6 Gaging Station GS27 Mean Daily Discharge (cubic feet per second)

Day	April-99	May-99	June-99
1	0 0000	0 0046	0 0000
2	0 0012	0 0001	0 0000
3	0 0001	0 0000	0 0000
4	0 0004	0 0000	0 0000
5	0 0000	0 0000	0 0000
6	0 0000	0 0000	0 0000
7	0 0000	0 0000	0 0000
8	0 0000	0 0000	0 0000
9	0 0000	0 0000	0 0001
10	0 0000	0 0000	0 0003
11	0 0000	0 0000	0 0010
12	0 0000	0 0000	0 0000
13	0 0007	0 0000	0 0000
14	0 0027	0 0000	0 0011
15	0 0061	0 0000	0 0019
16	0 0007	0 0000	0 0002
17	0 0028	0 0000	0 0000
18	0 0003	0 0000	0 0000
19	0 0000	0 0000	0 0000
20	0 0000	0 0031	0 0000
21	0 0002	0 0000	0 0000
22	0 0141	0 0002	0 0000
23	0 0060	0 0000	0 0000
24	0 0037	0 0000	0 0000
25	0 0018	0 0000	0 0000
26	0 0000	0 0000	0 0000
27	0 0000	0 0000	0 0000
28	0 0006	0 0000	0 0000
29	0 0077	0 0000	0 0000
30	0 0099	0 0000	0 0000
31	NA	0 0000	NA
Monthly Average (cfs)	0 002	0 000	0 000

Monthly Discharge

Cubic Feet	5084	701	397
Gallons	38028	5246	2968
Acre-Feet	0 117	0 016	0 009

Note mean flow values are reported to the nearest 0 001 cfs, values less than 0 0005 cfs are reported as zero

Table 4-5 Gaging Station GS11 Mean Daily Discharge (cubic feet per second)

Day	April-99	May-99	June-99
1	0 000	0 000	0 000
2	0 000	0 000	0 000
3	0 000	2 364	0 000
4	0 000	4 759	0 000
5	0 000	4 456	0 000
6	0 000	4 479	0 000
7	0 000	4 541	0 000
8	0 000	4 502	0 000
9	0 000	4 169	0 000
10	0 000	2 873	0 000
11	0 000	2 294	0 000
12	0 000	2 211	0 000
13	0 000	1 915	0 000
14	0 000	1 616	0 000
15	0 000	1 106	0 000
16	0 000	0 601	0 000
17	0 000	1 402	0 000
18	0 000	0 580	0 000
19	0 000	0 000	0 000
20	0 000	0 000	0 000
21	0 000	0 000	0 000
22	0 000	0 000	0 000
23	0 000	0 000	0 000
24	0 000	0 000	0 000
25	0 000	0 000	0 000
26	0 000	0 000	0 000
27	0 000	0 000	0 000
28	0 000	0 000	0 000
29	0 000	0 000	0 000
30	0 000	0 000	0 000
31	NA	0 000	NA
Monthly Average (cfs)	0 000	1 415	0 000

Monthly Discharge

Cubic Feet	0	3790208	0
Gallons	0	28352723	0
Acre-Feet	0 00	87 00	0 00

Note Mean flow values are reported to the nearest 0 001 cfs, values less than 0 0005 cfs are reported as zero

Table 4-4 Gaging Station GS10 Mean Daily Discharge (cubic feet per second)

Day	April-99	May-99	June-99
1	0 074	1 880a	0 100
2	0 306	0 476	0 101
3	0 149	0 254	0 098
4	0 164	0 171	0 096
5	0 146	0 146	0 096
6	0 085	0 140	0 093
7	0 073	0 139	0 093
8	0 063	0 124	0 087
9	0 055	0 110	0 189
10	0 046	0 177	0 288
11	0 038	0 105	0 459
12	0 032	0 098	0 091
13	0 404	0 095	0 070
14	0 846	0 090	0 397
15	1 158	0 088	0 637
16	0 168	0 138	0 148
17	0 403	0 096	0 096
18	0 255	0 087	0 081
19	0 085	0 085	0 074
20	0 062	1 088a	0 072
21	0 212	0 105	0 072
22	3 401a	0 290	0 071
23	2 253	0 130	0 071
24	1 136	0 157	0 068
25	1 196	0 113	0 071
26	0 379	0 097	0 071
27	0 187	0 108	0 074
28	0 282	0 097	0 076
29	2 756a	0 122	0 070
30	3 903a	0 099	0 060
31	NA	0 099	NA
Monthly Average (cfs)	0 677	0 226	0 136

## Monthly Discharge

Cubic Feet	1755369	605296	351592
Gallons	13131075	4527929	2630089
Acre-Feet	40 29	13 89	8 07

Note mean flow values are reported to the nearest 0 001 cfs, values less than 0 0005 cfs are reported as zero

<sup>a</sup> Contains data estimated from field observations and electronic record at adjacent or comparable gages

Table 4-3 Gaging Station GS08 Mean Daily Discharge (cubic feet per second)

Day	April-99	May-99	June-99
1	1 304	3 155	0 000
2	1 492	3 149	0 000
3	0 978	3 099	0 000
4	0 695	2 452	0 000
5	0 221	2 137	0 000
6	0 000	2 148	0 000
7	0 000	2 144	0 000
8	0 000	2 045	0 000
9	0 000	1 368	0 000
10	0 000	1 421	0 000
11	0 000	1 640	0 000
12	0 000	1 575	0 000
13	0 000	1 681	0 000
14	0 000	1 901	0 000
15	0 000	1 656	0 000
16	0 000	1 068	0 000
17	0 000	1 901	0 000
18	0 000	1 404	1 689
19	0 000	0 000	2 846
20	0 000	0 000	2 602
21	0 000	0 000	2 140
22	0 000	0 000	1 990
23	0 000	0 000	1 848
24	0 000	0 000	1 613
25	0 000	0 000	1 354
26	1 728	0 000	1 116
27	2 954	0 000	0 989
28	2 304	0 000	1 851
29	2 332	0 000	2 098
30	2 709	0 000	0 486
31	NA	0 000	NA
Monthly Average (cfs)	0 557	1 159	0 754

Monthly Discharge

Cubic Feet	1444305	3105484	1954451
Gallons	10804154	23230632	14620312
Acre-Feet	33 16	71 29	44 87

Note Mean flow values are reported to the nearest 0 001 cfs, values less than 0 0005 cfs are reported as zero

Table 4-2 Gaging Station GS03 Mean Daily Discharge (cubic feet per second)

Day	April-99	May-99	June-99
1	0 914	14 789	0 000
2	1 112	9 865	0 000
3	0 744	6 009	0 000
4	0 579	7 020	0 000
5	0 306	6 287	0 001
6	0 020	6 176	0 000
7	0 006	6 244	0 000
8	0 001	6 197	0 000
9	0 001	5 341	0 000
10	0 000	4 211	0 000
11	0 000	3 535	0 000
12	0 000	3 407	0 000
13	0 001	3 350	0 000
14	0 005	3 335	0 000
15	0 007	2 191	0 000
16	0 101	1 504	0 000
17	0 081	2 789	0 000
18	0 210	1 996	0 786
19	0 208	0 047	2 030
20	0 044	0 021	1 913
21	0 014	0 478	1 590
22	1 425	0 064	1 460
23	3 470	0 088	1 408
24	3 551	0 104	1 199
25	8 270	0 035	0 984
26	5 271	0 015	0 805
27	3 786	0 002	0 715
28	2 247	0 001	1 305
29	11 462	0 001	1 559
30	21 623	0 000	0 497
31	NA	0 000	NA
Monthly Average (cfs)	2 182	3 068	0 542

Monthly Discharge

Cubic Feet	5655608	8216869	1404304
Gallons	42306891	61466452	10504926
Acre-Feet	129 82	188 61	32 23

Note Mean flow values are reported to the nearest 0 001 cfs, values less than 0 0005 cfs are reported as zero

## 4.1 FLOW MONITORING

Table 4-1 Gaging Station GS01 Mean Daily Discharge (cubic feet per second)

Day	April-99	May-99	June-99
1	0 083	18 763a	0 176
2	0 152	14 772a	0 146
3	0 284	3 205	0 911
4	0 405	1 845	1 919
5	0 540	1 199	1 920
6	0 376	0 980	1 814
7	0 253	0 857	1 864
8	0 146	0 707	2 364
9	0 110	0 598	2 357
10	0 080	0 634	1 389
11	0 073	0 599	0 303
12	0 078	0 486	0 289
13	0 102	0 428	0 201
14	0 557	0 384	0 725
15	0 845	0 327	1 052
16	0 640	0 313	1 069
17	0 730	0 397	0 689
18	1 856	0 300	0 664
19	1 095	0 252	1 045
20	0 543	0 612	0 204
21	0 430	0 861	0 085
22	1 974	0 446	0 044
23	3 435	0 611	0 029
24	5 025	1 112	0 023
25	12 157	0 633	0 013
26	7 259	0 448	0 009
27	2 815	0 340	0 000
28	1 503	0 326	0 000
29	15 286a	0 309	0 000
30	29 979a	0 275	0 000
31	NA	0 218	NA
Monthly Average (cfs)	2 960	1 717	0 710

## Monthly Discharge

Cubic Feet	7673299	4599884	1840624
Gallons	57400263	34409522	13768827
Acre-Feet	176 13	105 58	42 25

Note Mean flow values are reported to the nearest 0.001 cfs, values less than 0.0005 cfs are reported as zero

<sup>a</sup> Contains data estimated from field observations and electronic record at adjacent or comparable gages

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### 3.2 MOUND PLUME SUMMARY DATA

Table 3-5 Mound Plume Locations SW061 and SW132

Analyte	SW061	SW132	SW061	SW132
	8/4/98	8/4/98	11/9/98	11/9/98
Pu 239/240, pCi/l	0 005	0 002	0 007	0 028
Am 241, pCi/l	0 022	0 020	0 013	0 041
Silver, dissolved, ug/l	<0 1	<0 1	<0 05	<0 05
Aluminum, total, ug/l	52 8	48 0	77 1	2500
Arsenic, total, ug/l	0 6 B	1 0 B	0 45 B	1 5
Barium, total, ug/l	176 9	114 9	125	97 1 B
Beryllium, total, ug/l	<0 1	<0 1	<0 05	0 13 B
Cadmium, dissolved, ug/l	0 1 B	0 2 B	30 5	0 31
Copper, dissolved, ug/l	4 4	5 2	1 1 B	1 6 B
Iron, total, ug/l	328 1	254 2	166	4110
Mercury, total, ug/l	<0 1	<0 1	<0 1	0 11
Manganese, total, ug/l	43 8	40 7	38 9	181
Nickel, dissolved, ug/l	2 9 B	2 3 B	0 67 B	0 66 B
Lead, dissolved, ug/l	0 3 B	0 5 B	0 26 B	0 42 B
Antimony, total, ug/l	1 3	27 4	4 3	25 0
Selenium, dissolved, ug/l	1 4	1 7	0 33 B	0 23 B
Zinc, dissolved, ug/l	29 0	31 5	46 0	103
EPA VOA Method 8260, compounds found >RFCA Seg 5 Action Level Vinyl Chloride, ug/l	9			

B - Absolute value of the analyzed result is less than the Contract Required Detection Limit (CRDL)



Table 3-3 Ponds - Interior and Terminal

Pond A-3 discharged 4/19/99-4/27/99, 4/30/99-5/9/99, 5/24/99-5/28/99, 6/21/99-6/24/99, Pond A-4 discharged 5/3/99-5/18/99, Pond B-5 discharged 4/1/99-4/5/99, 4/26/99-5/18/99, 6/18/99-6/30/99, and Pond C-2 pumped discharged 6/3/99-6/10/99, direct discharged 6/14/99-6/21/99

Location, Parameter and Units	Measured 30-day Average	Limit 30-Day Average	Measured 7-Day Average	Limit 7-Day Average	Measured Daily Minimum	Limit Daily Minimum	Measured Daily Maximum	Limit Daily Maximum	Measured Result
Pond A-3 (Outfall 002) pH, SU	N/A	N/A	N/A	N/A	7.4 - 7.9	6.0	8.0 - 8.3	9.0	N/A
NO3/NO2, mg/l	0.25 - 1.6	10	N/A	N/A	N/A	N/A	0.5 - 1.9	20	N/A
Pond A-4 (Outfall 005A) Total Cr, ug/l	N/A	N/A	N/A	N/A	N/A	N/A	<2	50	N/A
WET									
Cenodaphnia	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	>100
Fathead Minnows	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	>100
Pond B-5 (Outfall 006A) Total Cr, ug/l	N/A	N/A	N/A	N/A	N/A	N/A	<2	50	N/A
WET									
Cenodaphnia	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	>100
Fathead Minnows	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	>100
NO3/NO2, mg/l*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pond C-2 (Outfall 007A) Total Cr, ug/l	N/A	N/A	N/A	N/A	N/A	N/A	<1	50	N/A
WET									
Cenodaphnia	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	>100
Fathead Minnows	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	>100

\* Sample and analysis required only if Pond B-3 is bypassed

N/A Not applicable

SU Standard units

TRC Total residual chlorine

WET Whole Effluent Toxicity

### 3 1 NPDES SUMMARY DATA

Table 3-1 Pond B-3 (Outfall 001A)

Dates of discharge 4/1/99 - 4/7/99, 4/9/99 - 6/30/99

Parameter & Units	Measured 30-day Average	Limit 30-Day Average	Measured 7-Day Average	Limit 7-Day Average	Measured Daily Maximum	Limit Daily Maximum
NO3/NO2, mg/l	5.5 - 6.7	10	7.6 - 12.0	20	N/A	N/A
TRC, mg/l	N/A	N/A	N/A	N/A	0.07 - 0.08	0.5
BOD5, mg/l	5.5 - 8.5	a	N/A	N/A	7.0 - 11.0	a
CBOD5, mg/l	2.5 - 3.8	a	N/A	N/A	3.0 - 9.0	a
TSS, mg/l	<5 - 9	a	N/A	N/A	<5 - 13	a

a Report Only

N/A Not Applicable

TRC Total Residual Chlorine

TSS Total Suspended Solids

BOD5 Biochemical Oxygen Demand, 5-Day Test

CBOD5 Carbonaceous Biochemical Oxygen Demand, 5-Day Test

Note Results are the range of value measured during the reporting period

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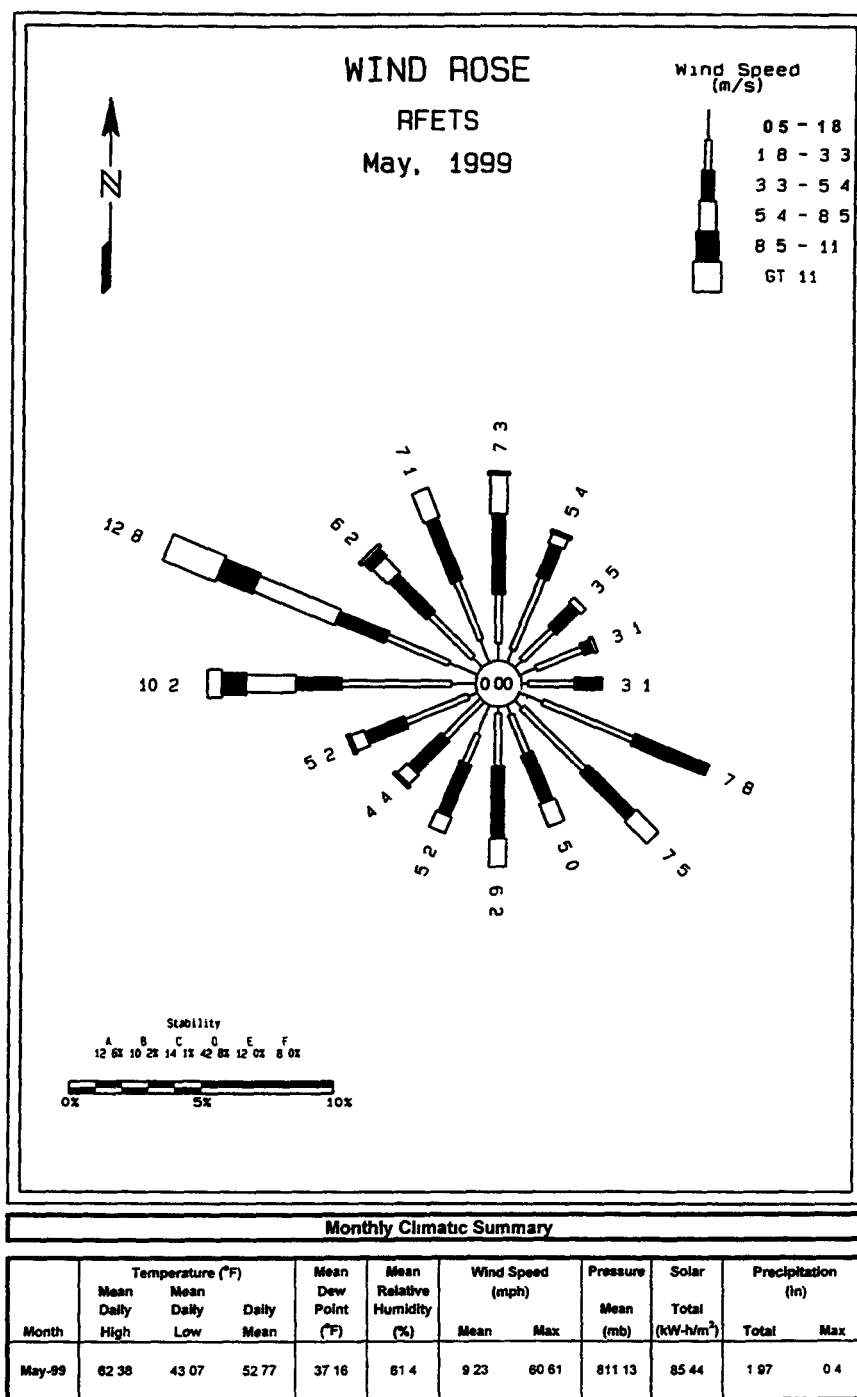


Figure 2-2 Windrose for Rocky Flats Environmental Technology Site for May 1999

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## 1 2 2 Perimeter Sampler Locations - Dose Rate Graphs

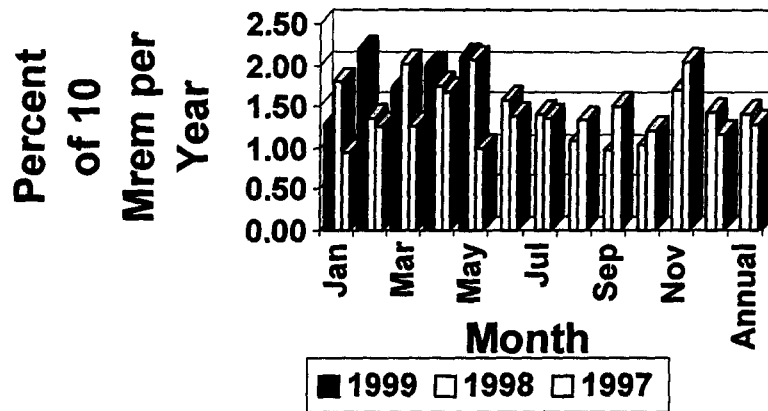
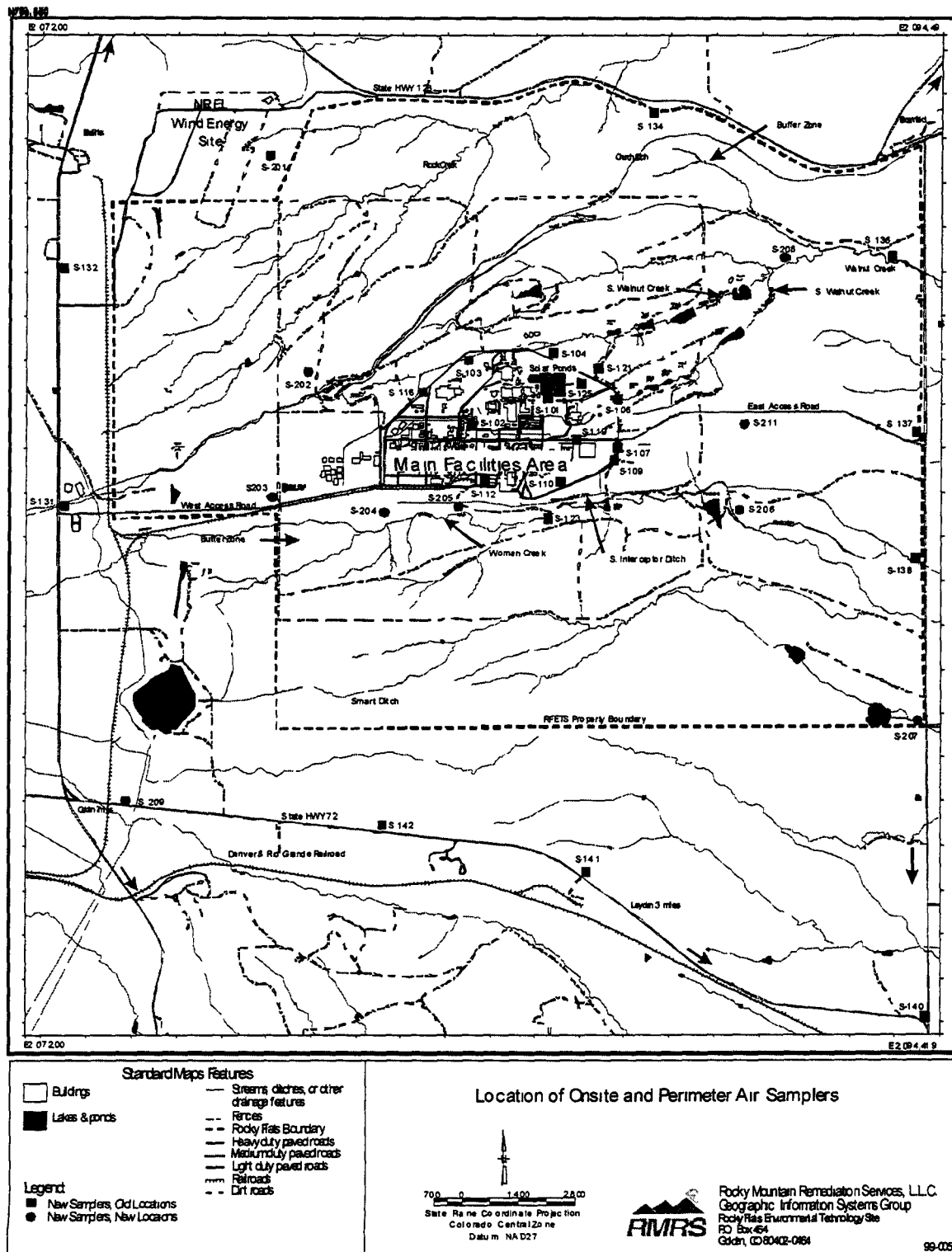


Figure 1-3 Offsite Dose Rate Summary

The above graph illustrates the monthly estimated maximum potential dose rates at the perimeter sampler showing highest radionuclide concentrations, including contributions from naturally occurring uranium isotopes. All of the highest dose rates were seen at either location S-132 or S-140, except for March 1999 where S-209 showed the highest dose rate. The monthly dose rates were less than 2.5 percent of the 10 mrem standard.

Map 1-1 Location of Onsite and Perimeter Air Samplers



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## **Ambient Air**

Complete isotopic analytical data through May 1999 for coarse (>10 micrometers) and fine (<10 micrometers) ambient particles are included in this report. All data are within the normally observed ranges of concentrations for their respective locations. Data for June 1999 are not complete at this time.

During the month of April, very high winds caused some of the filters to become dislodged from the filter cartridge edges. These cartridges were exchanged and the filters were composited for isotopic analysis. Furthermore, during the cartridge exchange, the S-136 cartridge was dropped and some sample loss may have occurred. The data contained in this report reflect uncertainties associated with these sampling problems.

## **Meteorology and Climatology**

Meteorological data are routinely measured from instruments on a 61-meter tower located in the west buffer zone at an elevation of 1,870 meters (6,140 feet) above sea level. All meteorological data are collected on a real-time basis and are transmitted as 15-minute averaged values to the Computer Assisted Protective Action Recommendations System (CAPARS) model for emergency response purposes. The same data are logged at the tower and downloaded for air quality and surface water modeling purposes.

Climatic summaries and Windroses for April through June 1999 are included in this report. As a result of the new protocols used to validate the meteorological data, each 15-minute averaged observation is validated, rather than the entire observation record for the same time period (which might contain 70 different observations - i.e. temperature, wind speed, etc.). Missing data will be reported with respect to the wind speed and wind direction values, for example, rather than recording all observations missing for the same 15 minute period. There were no missing wind speed/direction data for this reporting period.

## **Surface Water**

Surface water analytical data collected during second quarter of FY 99 (April, May, and June) for NPDES/FFCA permit compliance are presented in this report. All reported data are consistent with historical measurements and within permit limitations.

Quarterly Whole Effluent Toxicity (WET) testing data for the period April to June 1999 show some toxicity at the Sewage Treatment Plant (Outfall STP). The sample collected on April 1, 1999 showed toxicity for *Pimephales promelas* (fathead minnows), but not for *Ceriodaphnia dubia* (water fleas). No unusual or off-normal conditions were noted at the time the WET test sample was collected. The toxicity is most likely due to a combination of ammonia concentration and pH. There is no effluent limitation for WET testing and it is reported as information only.

Included in this report are two surface water locations that monitor the Mound Site area. These locations are SW061 and SW132 and are sampled quarterly for isotopic Pu/Am, selected total and dissolved metals and EPA VOA Method 8260.

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